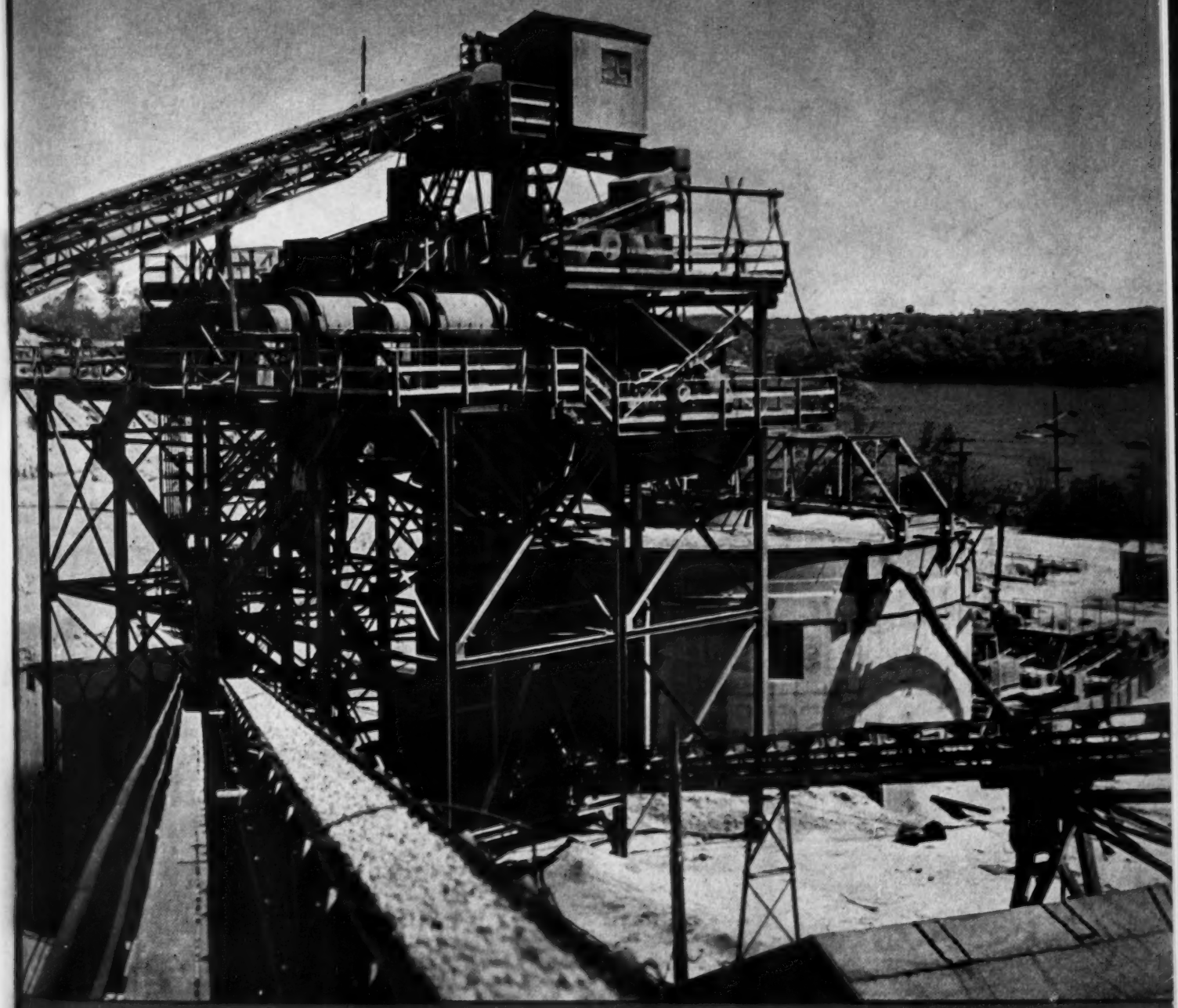
THE INDUSTRY'S RECOGNIZED AUTHORITY

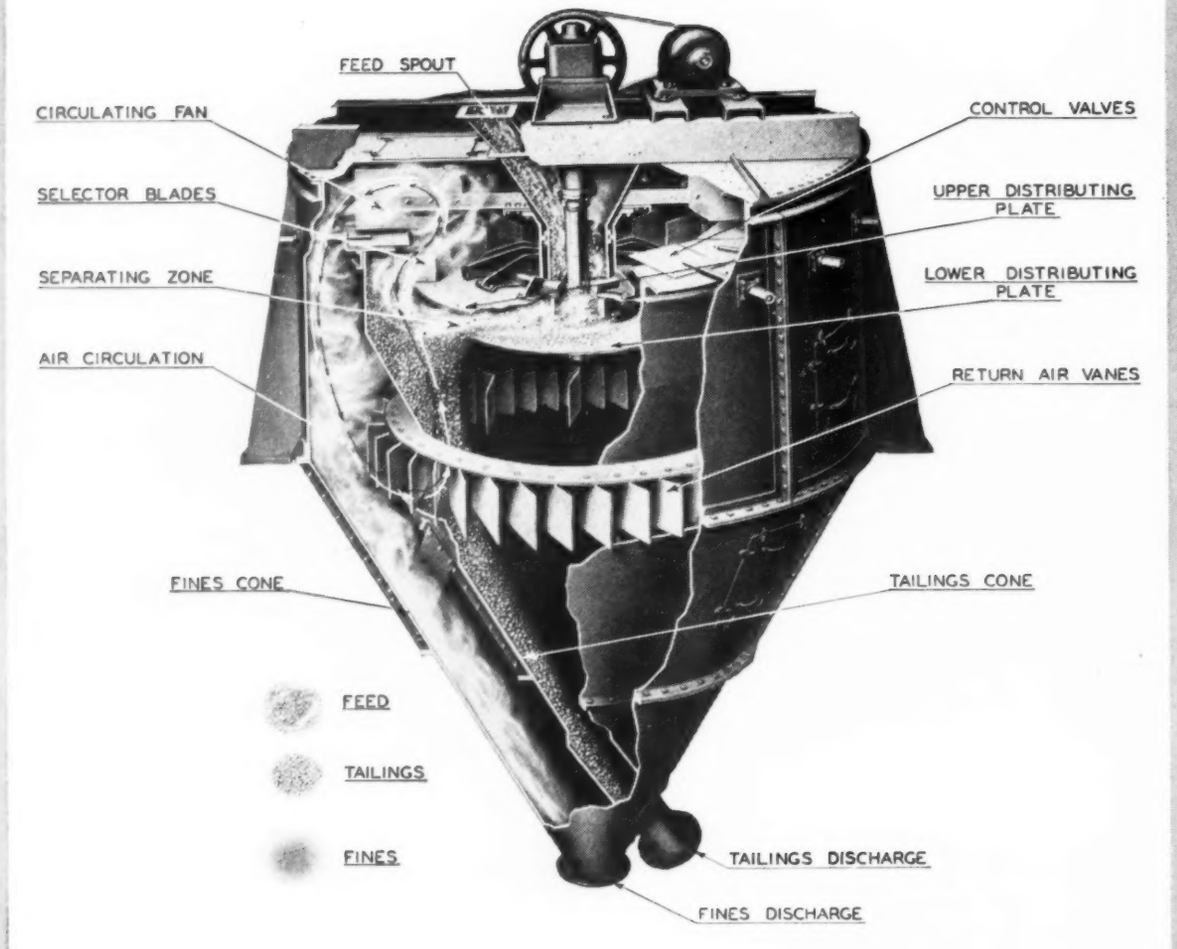
ROCK PRODUCTS

LARGEST PRODUCER CIRCULATION IN THE HISTORY OF THE FIELD



...r-screening station of new sand and gravel plant, New York Trap Rock Corp., Port Washington, N. Y.

ANNUAL REVIEW ISSUE — DECEMBER, 1948



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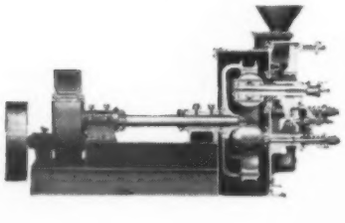

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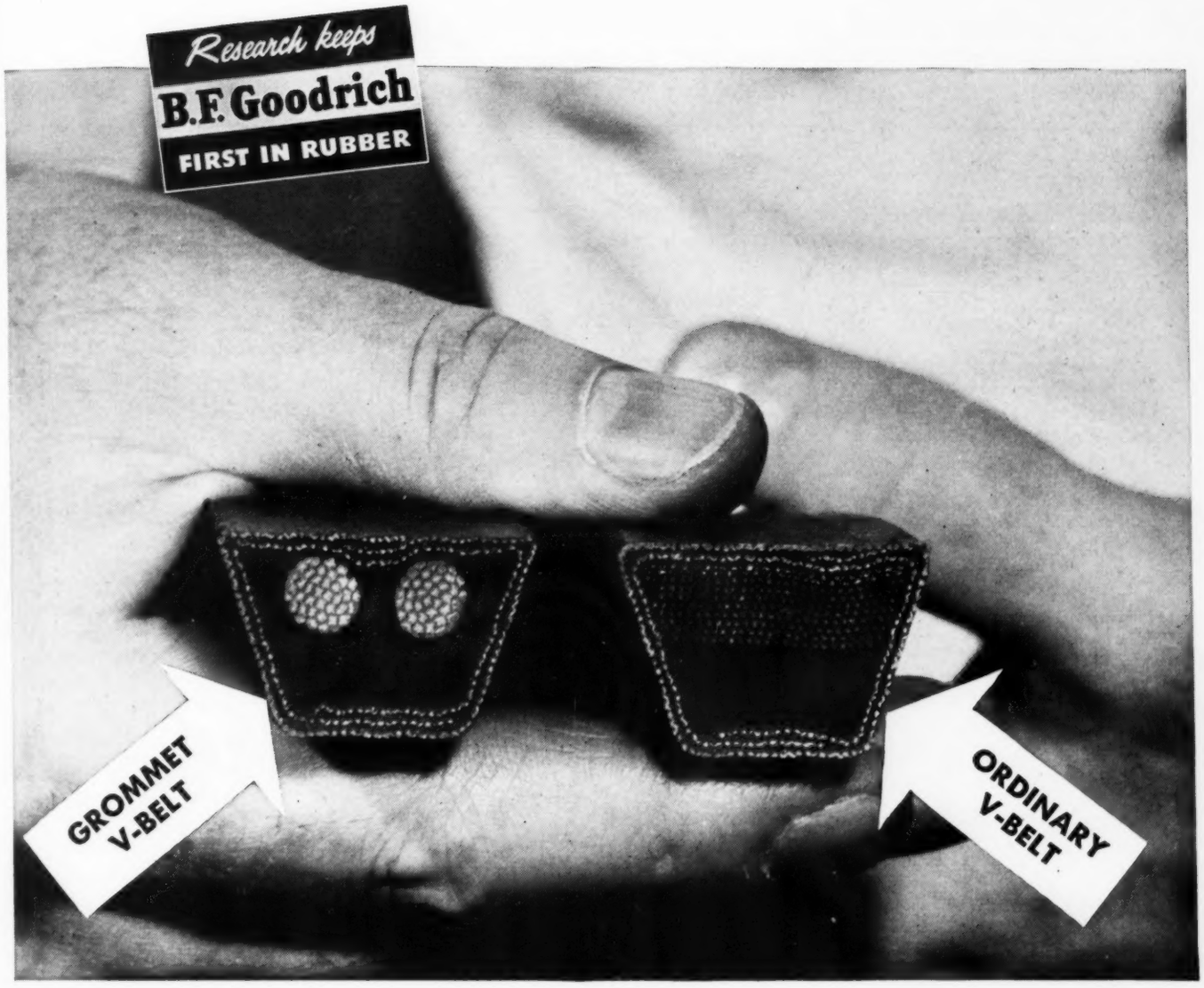

Cut V-belt costs 20 to 50% with new B. F. Goodrich grommet V-belt

Lasts longer, stands shock loads better, costs no more

A NEW patented construction by B. F. Goodrich puts all the cord material in a V-belt to work in the form of twin, endless, extra-flexible grommets — *not* cables — placed close to the driving faces of the belt (see left, above). No "lazy" cords in the interior to shirk their share of the load. Because grommets are endless they are more flexible, with no stiff section such as occurs in an ordinary cable, with spliced or overlapped ends.

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How to get genuine grommet V-belts — Twin grommet construction is an exclusive, patented B. F. Goodrich development — no other manufacturer can make grommet V-belts. Now available in "D" and "E" sections. To be sure you get genuine grommet V-belts see your B. F. Goodrich distributor. *The B.F.Goodrich Company, Industrial Products Division, Akron, Ohio.*

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RUBBER FOR INDUSTRY

DECEMBER, 1948

ROCK PRODUCTS

THE INDUSTRY'S RECOGNIZED AUTHORITY

VOL. 51, No. 12

Bror Nordberg
Editor

Nathan C. Rockwood
Editorial Consultant

This Month

ROCK PRODUCTS is published monthly by MACLEAN-HUNTER Publishing Corporation, 309 West Jackson Blvd., Chicago 6, Illinois; Horace T. Hunter, President; E. R. Gauley, Vice President; J. L. Frazier, Secretary. Entered as second-class matter, Jan. 30, 1936, at the Chicago, Ill. post office under the act of Mar. 3, 1879. Additional entry at Milwaukee, Wis.
ROCK PRODUCTS is indexed regularly by Engineering Index, Inc.

SUBSCRIPTION INFORMATION

Subscription Price: United States and Possessions, Canada one year, $2.00; two years, $3.00; three years, $4.00. Pan American, one year, $4.00; two years, $7.00; three years, $10.00. All other foreign, one year, $6.00; two years, $12.00; three years, $15.00. Twenty-five cents for single copies. Indexed in the Industrial Arts Index.
Canadian subscriptions and remittances may be sent in Canadian funds to ROCK PRODUCTS, P. O. Box 100, Terminal "A," Toronto, Canada.
To Subscribers—Date on wrapper indicates issue with which your subscription expires...In writing to have address changed, give old as well as new address.

"WE HEAR..."

December, 1948

Approximately 70 contractors built 6,188,750 sq. yd. of soil-cement surfacing during 1947, the Portland Cement Association reports. Projects varied in size from 500 sq. yd. to 220,174 sq. yd.

* * * * * * * * * * *

Highway construction figures, in terms of dollar volume, should reach a new all-time high of $1,750,000,000 in 1948, judging from figures for October, the peak construction month, and totals for the past two years. According to the American Road Builders' Association, in October, 1946, $100,000,000 was spent for road building. In October, 1947, this total rose to $178,000,000. At this rate, October, 1948, is expected to show a total expenditure of $250,000,000. The ratio for the total yearly volume is: $772,000,000 for 1946; $1,500,000,000 for 1947; and the $1,750,000,000 estimated for 1948.

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Wages or factory workers in 1949 probably will average $1.39 per hour, as compared to $1.30 per hour in 1948.

* * * * * * * * * * *

Theft of several thousand dollars worth of materials at the Willey-Ruckstuhl Gravel Co., New Baltimore, Ohio, should serve as a warning to other producers to keep equipment under lock and key. Thieves drove a truck into the yards of the company on three different occasions, taking away five rear end assemblies of trucks valued at $1200 one time, six Diesel engine heads, gears, another rear end assembly and miscellaneous steel worth $1200 the second time, and $2000 in building materials the third time. Building and keeping an adequate inventory of replacement and repair parts is now an important aim in anticipation of allocations.

* * * * * * * * * * *

A new, laminated board that repels rats is being produced by U. S. Plywood Corp. The 5/16-in. thick board is a combination of hardwood veneer plus an asphalt-impregnated fiber face, and relies on its surface toughness to thwart gnawing rodents.

* * * * * * * * * * *

The mineral-wool industry can trace its ancestry back to a pagan goddess. In 1836 a scientific expedition found a wool-like substance called "Pele's hair," on the slopes of Mt. Kilauea in the Hawaiian Islands. Pele was the goddess of volcanoes, and the "wool" was formed by volcanic action, a less-refined application of heat than the technique used today in making mineral wool. Hawaiian natives used to blanket their huts with the wool-like material, because it kept them cool on hot days and warm in cold weather.

* * * * * * * * * * *

New construction volume is expected to proceed at a rate of $18,500,000,000 for the first half of 1949, against $17,000,000,000 for the first half of 1948.

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England's dollar shortage is being felt in American industry. An example is the New England Lime Co., Adams, Mass. The company's net income suffered a sharp drop when England cancelled purchases of cigarette paper from the United States, due to the dollar shortage. Much of the firm's output of calcium carbonate is sold to the cigarette paper manufacturing industry.

WE HEAR

Production of brick and structural clay tile for the first six months of 1948 is ahead of the record post-war production in 1947. More than 2½ billion brick equivalents were produced in the first six months of this year, an 11 percent increase over the first six months of 1947, and structural clay tile production has reached 622,000 tons, Roy A. Shipley, president of the Structural Clay Products Institute, announced.

* * * * * * * * * * *

A gravel pit, owned by Belpre Sand and Gravel Co., Marietta, Ohio, recently yielded the tusk of an ancient elephant, estimated to be 200,000 years old. The tusk, 8 ft. long and 20 in. in circumference at the base, was classed as one of the best-preserved tusks of its kind.

* * * * * * * * * * *

Under some conditions, it is possible for an employer to collect from a union for wages that have been paid for services not performed. The National Labor Relations Board ordered a union to reimburse an employer for such wages in a proceeding in which the union was accused of violating the anti-featherbedding provision of the Taft-Hartley Act by asking the employer to pay four men to do the work of two.

* * * * * * * * * * *

Word comes from the Colorado School of Mines at Golden, Colo., that synthetic mica is being manufactured there under contract with the War Department. According to Dr. M. F. Coolbaugh, former president of the school, the raw materials, finely crushed feldspar and carefully measured quantities of magnesium oxide and magnesium fluoride, are mixed and melted in a special furnace to temperatures up to 2700 deg. F. and allowed to cool slowly. Mica crystals "grow" as the melt cools. So far, crystals thus produced have been relatively small, but large size is not the primary aim of the work.

* * * * * * * * * * *

Phosphate rock deposits near Pocatello, Idaho, may soon be the site of a new chemical industry, being pioneered by Westvaco Chemical Corp., New York, N.Y. Initial installation consists of an electric furnace for experimental purposes.

* * * * * * * * * * *

New construction of all classes put in place in September, valued at $1,804,000,000, set another new monthly record, as estimated by the Commerce and Labor Departments. This figure represents a rise of 1 percent over August, 1948, and 27 percent over the figure for September, 1947. Value of new construction put in place during the first nine months of this year, based on the September estimate, was $13,000,000,000, 34 percent above the total for the comparable period of 1947.

* * * * * * * * * * *

An estimate of business trends for 1949 by U. S. News & World Report states that outlook for the machinery industry continues favorable. Overall production for the year may hit the peak of 284 percent of pre-war output reached in the first quarter of 1948, with strong demands continuing for heavy electrical and mining machinery.

* * * * * * * * * * *

New products recently announced by the U. S. Rubber Co. include a conveyor belt possessing 2½ to 4 times the strength of conventional belts; and a golf ball with silicone center and rubber thread wound by electronic control.

* * * * * * * * * * *

Boom in construction of houses and other private buildings may weaken a little in 1949, according to a U. S. News and World Report survey. Private building is estimated officially at $13,850,000,000 for 1948, and unofficial forecasts place 1949 outlays at $13,550,000,000. On the other hand, public building is expected to cost $4,150,000,000 this year, and may rise to as much as $4,850,000,000 in 1949.

The Editors

★ ★ ★ Editor's Page

Problems in Producing "Modern" Specification Aggregates

IN REVIEWING developments of the year just ending, in their relation to rock products, the new specifications of the Corps of Engineers for concrete sand overshadow all other considerations. Whether or not the aggregates industries agree on the validity of the new requirements for gradation and fineness, manufactured sand is currently getting preference over natural sand for construction of large mass concrete dams and the specifications as drawn up must be met with accuracy.

The government in its determination to achieve the "ideal" in concrete has centered its attention on the aggregates as one important factor. Articles in this issue of ROCK PRODUCTS examine the specifications analytically and discuss some of the methods of production in use. Here we merely attempt to point out some of the difficulties and conditions that ought to be anticipated in advance by those who would bid to supply aggregates for War Department contracts.

Rejections

Experience thus far has not all been bad but, for some producers with years of experience in commercial plant operation, the percentage of rejections is very high. These producers are finding that the permissible tolerances between consecutive testing sieves have narrowed, that the general trend in sand size distribution is downward, and that the allowable variation of 0.10 from an established fineness modulus is quite another thing to fall within regularly from the 0.20 variation that has hitherto been acceptable. This uniformity provision is responsible for much of the rejections. And, having met the requirement with some part of the tonnage through extreme care in production, it is difficult in cases to reconcile dumping that sand through a car-unloading trestle at the job, where it is shoved here and there by bulldozers before being reclaimed by belt conveyors as acceptable and uniform material for batching. The human element is a factor and some inspectors are more vigilant than others.

Meeting a fineness modulus figure established between the maximum and minimum specified isn't all there is to it either. Army engineers experiment as a job progresses and sometimes decide that the fineness modulus must be altered for best results. The producer must, of course, cooperate even if it means the addition of another crusher, setting existing crushers up tighter and the re-routing or re-proportioning of material flow between principal production equipment.

The utmost in flexibility of plant design is absolutely essential to permit quick changes and adjustments, as well, to meet problems in gradation due to varying conditions of the stone which include differences in composition and wetness or dryness and which, without compensation, could easily result in rejections. Regulatory devices at all feed points are desirable.

Factors in Plant Design

Army engineers prefer that the coarse and fine aggregates be produced of stone from the same or similar geological formations in compliance with their thermal compatibility requirements, and thoroughly explore and test sources before recommending where a plant be established. Approval of a source of stone does not necessarily guarantee acceptance for, in some of the specifications, the right is reserved to reject production from localized areas or strata that in the opinion of the contracting officer will yield material that will prove unsatisfactory. Stone which breaks into thin or flat elongations may not be approved regardless of the processing equipment used.

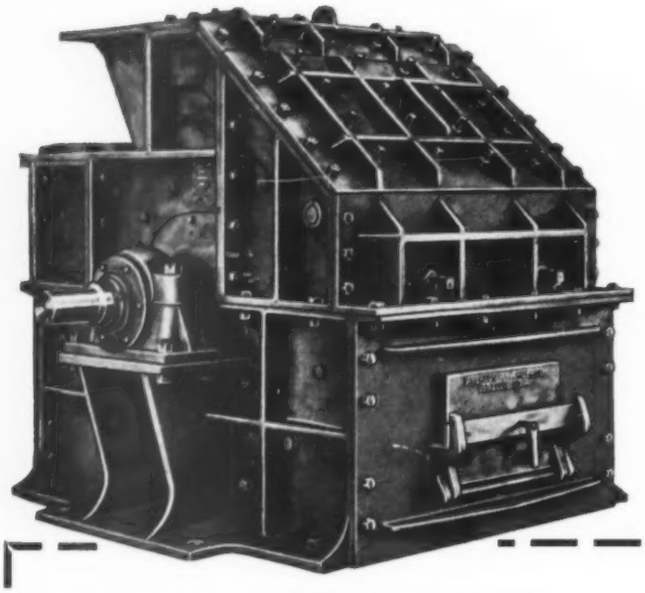
Preliminary to establishing a plant, therefore, thorough core drilling of the deposit is recommended, particularly to determine silica content if the stone is limestone. Cursory exploration at one site fixed the silica content as one percent and hammermills were selected for sand manufacture, only to discover that the silica percentage exceeded ten percent in other locations of the development. Maintenance became prohibitive and it was necessary to install a cone crusher ahead of the hammermills to take much of the load. The tonnage involved usually is sufficient to justify more than ordinary diligence to learn the nature of the stone throughout the projected quarry site.

Installation of cone crushers, ring-rolls or other types to perform part of the reduction to sand sizes in plants where hammermills are needed to produce fines is also recommended where there are no sideline markets for excess production of fines.

Finally, the producer must recognize that penalties apply in government contracts, for default in delivery of the product according to schedule, and, at least psychologically, he must accustom himself to having outsiders try to tell him how to run his plant.

Bror Nordberg

BALANCED PRODUCTION through FLEXIBILITY with AMERICAN HAMMERMILLS



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American Hammermills offer 3 types of hammers, engineer-designed to fit specific reduction jobs.
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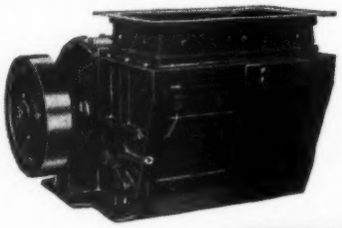
B — "Broadhead" for medium reduction.
C — "Splitter" for fine reduction.



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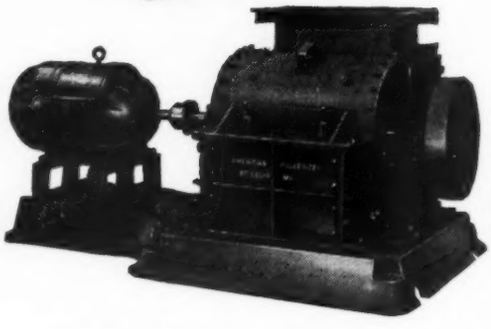

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Rocky's NOTES

By NATHAN C. ROCKWOOD

Back-Tracking May Help Solve a Problem

RECENTLY I SAT in on a lively discussion by eminent researchers on the current problem of concrete disintegration caused by the chemical reaction between certain aggregates and so-called "high alkali" portland cements. Presumably, because I had "stuck my neck out" in these columns on several occasions, the chairman asked me to expound some rather vague theories. The only comment I could make was that this mysterious sodium silicate reaction with high alkali cements, instead of being treated as a disease and consequently a detriment to concrete might eventually prove to be the very thing that everyone was looking for to form the stabilized silicates which are among the very best cements in Nature's own rocks.

Not much of a contribution, it must be admitted, and it is doubtful if anyone was impressed. The reason the idea keeps coming to mind is recollection of an article in *Engineering News* some 35 years ago, when I was a member of that journal's editorial staff. The article and a subsequent visit to Reclamation Service projects in the West must have left an impression that has persisted ever since, enough to have made me skeptical of some of the virtues claimed for present-day high-limed cements. Now having run down that article, the balance of this page is dedicated to a little known researcher, who, it may be, came closer to understanding this riddle than many who have followed him. If some of us had been more familiar with this early work, we might have been saved some entertaining but not very productive theorizing. It goes to prove that much has been cast overboard and forgotten about hydraulic cements which could prove very helpful in present-day research.

Function of Alkalies in Concrete

The man we are writing about is Rapier R. Coghlan, and his article "Blended or Sand-Cements; Results of Study and Experience of the U. S. Reclamation Service," *Engineering News*, June 19, 1913. At the time he wrote this he had the title of manufacturing cement chemist, U. S. Reclamation Service, Elephant Butte, N M. Keep that location in mind because the dam at Elephant Butte, N. M., which I visited during construction, is reputed to be one of the few that the present Bureau of Reclamation makes no apologies for. It is in excellent condition, after more than 30 years' service under natural conditions identical with those that have caused serious deterioration in similar dams.

Prior to 1913, according to Mr. Coghlan's article, the Reclamation Service had experimented for six years with blended portland cements —not for the purpose of improving them, or to resist alkali reaction, which they had not learned to be disturbed about, but to get satisfactory cements for isolated jobs at lower cost. In other words the purpose was to get satisfactory portland cement "extenders." Prior to that time there had been considerable—and enlightening—experience with so-called sand-cements, in which "sand" was interground with portland cement. Also, at that time the terms sand-cement, blended cement and puzzolan-portland cement were more or less synonymous.

Mr. Coghlan proceeded on the assumption, now universally conceded, that hydrating portland cement releases a large amount of hydrated lime. Simple chemistry tells us when a solution is basic or alkaline, to neutralize it and form a precipitate you add an acid. The most common acid-forming mineral is a reactive silica, preferably a colloidal form of silica or opal. He reasoned that many igneous and intrusive rocks contain this form of silica, as well as some sands and sandstones. Accordingly he experimented by grinding rocks taken from the sites of Elephant Butte dam and Arrow Rock dam in Idaho (also one of the "good" concrete dams; both subsequently built with blended cements). He determined their reactive or puzzolanic properties by blending one part by weight hydrated lime with one part pulverized rock, and making 1:3 standard sand mortar test specimens. After hardening, the specimens were stored in water, and tested at intervals in both tension and compression. Strengths obtained were comparable to portland cement specimens, although early strengths were low, and some blends showed no strength.

We now come to a very important conclusion which seems to have been overlooked but bears directly on the present problem of reactive aggregates. He concluded that: "These tests have generally shown that the materials which develop the most [puzzolanic] activity with hydrated lime are those containing the oxides of sodium and potassium in an available form." After describing how to determine whether the rock sample had such reactive sodium and potassium oxides, he took sodium oxide as an example of the probable reaction. First it combines with water to form sodium hydroxide, then with the reactive silica in the pulverized rock to form soluble sodium silicate (water glass). The water glass combines with hydrated lime to form insoluble monocalcium silicate, setting free again sodium hydroxide to continue the reaction. In this manner a small amount of sodium oxide seems capable of rendering a much larger amount of silica reactive. He suggested that the chemical reactions are:

$$Na_2O + H_2O = 2\ NaOH$$
$$2\ NaOH + SiO_2 = Na_2\ SiO_3 + H_2O$$
$$Na_2\ SiO_3 + Ca(OH)_2 = 2\ Na_4OH + CaSiO_3\ [CaO \cdot SiO_2]$$

To test this reaction, Mr. Coghlan tried a pulverized sandstone that did not show sodium and potassium oxides in available form, because they were combined with SO_4, and Cl. There was no puzzolanic reaction with hydrated lime. However, by adding a small percentage of sodium silicate, puzzolanic action developed and the test specimens continued to gain in strength.

That fact confirms a suspicion long harbored, that all good puzzolans, as tested by reaction with lime, must have soluble alkalies as well as active silica. Probably active alumina reacts in much the same way. Look at the analyses of all proved puzzolans, including blast-furnace slags and the best fly ash, and you will find that they contain appreciable amounts of sodium and potassium oxides. Hence, pure, pulverized, even soluble silica will have no puzzolanic reaction except with cements high enough in soluble alkalies to start the reaction. This probably accounts for the various test results reported on the properties of puzzolan-portland cements. If the puzzolan contains active alkali salts we may get a beneficial reaction with low alkali portland cement, but if the cement happens to be high in soluble alkalies a puzzolan without soluble alkalies may give better results. There probably is a total maximum alkali content which should not be exceeded.

Why then are soluble alkalies and the alkali silicates beneficial to concrete in a puzzolan, and detrimental in sand or coarse aggregate? It seems plausible that at least two factors enter the problem: (1) concentration and (2) timing of reactions. It appears undeniable that an active puzzolan combines with hydrated lime in concrete, but if the sodium hydroxide

(Continued on page 158)

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LABOR RELATIONS TRENDS

Year's Developments Brought to Date

By NATHAN C. ROCKWOOD

THIS ANNUAL REVIEW ISSUE offers an opportunity to summarize some of the material published through the year on this page, and to add any developments and prospective developments of interest to readers who have been following these Trends articles. We shall handle the subjects more or less chronologically, beginning with the January, 1949, issue.

Wage and Hour Law

In January we reported the hearings held by the Labor subcommittee of the U. S. House of Representatives investigating prospective and needed changes in the Fair Labor Standards Act. One of these changes emphasized by employer groups, including the National Sand and Gravel Association and the National Ready-Mixed Concrete Association, for which V. P. Ahearn, executive secretary, testified, was for clarification of the coverage of the Act; more particularly for a narrowing of the definition of the term "employes engaged in interstate commerce, or in the production of goods for interstate commerce," as distinguished from employes engaged in purely local or intra-state industries. The law was being stretched by the F.L.S.A. administrator to include employes of aggregate producers and ready-mixed concrete manufacturers who furnish materials locally for the repair and maintenance, or the construction, of structures such as bridges and pavements that are described as "instruments of interstate commerce."

Another point in which the law is clearly lacking is in defining an executive or administrative employe, who as such is exempt from the application of the law. A third point is the conflict on the meaning of "regular rate" of pay in computing time-and-a-half for time worked over 40 hours a week, (or 8 hours a day in the case of the Walsh-Healey public contracts law). All these defects have caused an enormous amount of controversy, and the law is still unchanged although both the House and Senate committees held long hearings and acquired volumes of testimony. The 80th Congress took no action on several bills introduced, possibly because the Congress was composed largely of lawyers and the members were reluctant to deprive their profession of such a lucrative source of employment.

During the year the Federal Courts decided many cases which served to confuse issues more than ever. The coup de grace was the decision of the United States Supreme Court in the now famous Bay Ridge longshoremen's case, in which it was held that premium pay for Saturdays, Sundays, Holidays and "undesirable hours" of any day as such was not lawful overtime pay, but must be added to the weekly amount and divided by 40 in determining the regular rate on which to base the overtime rate—in other words pyramiding the premium on the overtime rate. There were many similar cases decided in the lower courts. The Supreme Court has denied a rehearing of the Longshoremen's case.

The real issue last January, as it is now, is legislative law vs. administrative law, for while the courts decided many cases according to their interpretation of the letter of the law, the administrator of the F.L.S.A. has decided a great many more cases, which never reached the courts. His decisions were according to his individual judgment, and as the incumbent of the office changed, or he changed his mind, some previous interpretations were changed, so that throughout the year no employer could be sure whether or not he was adequately complying with the law.

Prospective Changes

With the change in political complexion of the 81st Congress, to meet in January, the best expert opinion is that the F.L.S.A. will be revised, although probably not in the directions that employers believe need the most clarification. First, the President-elect has pledged himself and his party to increase the minimum rate from the present 40c per hour to 75c. This is very likely to happen, but it will probably not change the situation much as it affects the operating or production employes in industry. It will set a minimum of $30 a week (for 40 hours) in the case of many clerical employes who possibly receive less at present.

Other changes which political commentators believe are likely to be made are based on a bill introduced by Senator Thomas of Utah in the 80th Congress. It is expected he will head the new Senate Labor Committee. With much of his bill the administrator of F.L.S.A. agrees. Senator Thomas' bill (see Trends article in June, 1948, issue) would extend the coverage of the Act to many employes now exempt, to include all those whose activities "affect" interstate commerce. This is the phrase used in the Labor-Management Relations Act, and is a fruitful source of controversy—for example does construction of any kind of a building affect interstate commerce? The National Labor Relations Board's general counsel says it does, some of the courts say it doesn't. Senator Thomas' revision apparently would complicate the situation, not clarify it.

Senator Thomas would narrow the exemption of employes in retail and service establishments to those of employers who have less than four establishments with a total volume of business not exceeding $300,000 per year. This would include many ready-mixed concrete and concrete products manufacturers who do a strictly local business. Another feature of Senator Thomas' bill is to modify the exemption of motor carriers' employes to extend the provisions of the overtime coverage to include all employes not now subject to the regulations of the Interstate Commerce Commission. This would obviously further complicate the motor-carrier problems of rock products producers. Another feature of Senator Thomas' bill is to extend coverage of the Act to seamen, now exempt, and remove the cost of board and lodging from the calculation of wages of seamen and other employes of floating equipment.

The F.L.S.A. administrator also advocated extending the coverage of the Act, but he would have the law clarified in respect to the definition of "overtime" and "regular" rates of pay, so that the extra pay for Saturdays, Sundays and Holidays would apply on the overtime rate, provided the premium pay is at least 50 percent in excess of the regular hourly rate. Since the U. S. Supreme Court's decision in the Longshoremen's case, the agitation for this change has been practically universal, including some union labor, so there is a very good chance it will be made.

Hearings of committees of both houses of the new Congress are expected to begin soon, if they have not already started by the time this is printed, and employers should be sure to inform their congressmen of the utmost importance of revising the F.L.S.A. promptly. It is at least one instance in which nearly all in industry regardless of political affiliation could have joined the President in chiding the 80th Congress for having done nothing.

Portal-to-Portal Pay Issue

In our February, 1948, issue were reviewed various lower court decisions on the legality of the Portal-to-Portal Act, passed in 1947, to relieve a situation similar to that which has developed under the Supreme Court's more recent decision in the Longshoremen's case. It will be remembered that the Portal-to-Portal Act grew out of the Supreme Court's decision in the Mt. Clemens Pottery Co. case, which opened the door to an avalanche of employe suits to cash in on time spent getting ready to go to work. That particular suit was returned to the District Court where it originated, and that court found the time actually involved was too little and too indefinite to set a price on. To prevent

(Continued on page 165)

Dual Impact Action Facts


Intercity Quarries
Kansas City, Missouri

. . . Proved by the Actual Experience of New Holland Breaker Operators

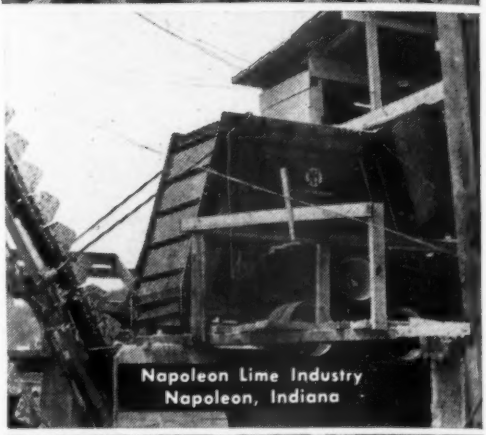
SUPERIOR PRODUCT "Engineers have awarded us contracts on the basis of the superior stone that Dual Impact Action produces."

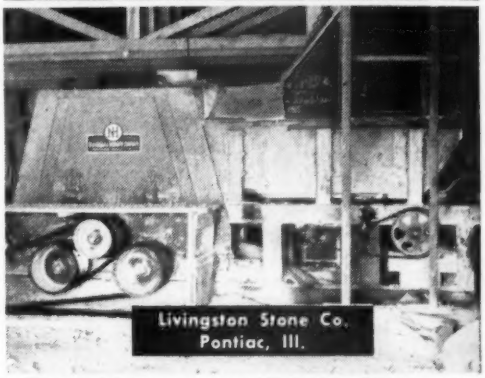
LOW MATERIAL HANDLING COST ". . . crushes run of the quarry minus 30" to 50% 3/4" down stone and 50% lime dust *in one operation.*"

LOW UPKEEP "The breaker itself, after crushing more than 110,000 tons shows no signs of wear."

GREAT CAPACITY "With the same crew, trucks and shovel and only one-third the horsepower we are producing fifty percent more tons with the one new breaker."

LOW POWER COST "In the first year power savings paid all maintenance and over $2000.00 beside."


Napoleon Lime Industry
Napoleon, Indiana


Livingston Stone Co.
Pontiac, Ill.

Ask your New Holland dealer to show you "The New Stone Age"—a color movie of the Double Impeller Breaker in action. See for yourself how less waste fines . . . reduced power requirements . . . add up to more profits for your pockets.


K. U. McCorkle
Milroy, Indiana


L. R. Falk
St. Ansgar, Iowa

Available in 4 sizes; 1520, 2020, 3030, 5050

NEW HOLLAND MANUFACTURING COMPANY
Division of New Holland Machine Co.
Mountville, Pa., U.S.A.

DOUBLE IMPELLER Breakers

the *Personal Side* of the news

P.C.A. Engineer

JOHN F. HALL has been appointed district engineer in charge of the New York office of the Portland Cement Association, Chicago, Ill. Mr. Hall succeeds E. M. FLEMING, who has retired after more than 22 years as a member of the Association staff. Under the supervision of M. J. McMillan, regional manager, Mr. Hall will direct field promotion in the States of Connecticut, New York and New Jersey.

Mr. Fleming joined the Association in 1926 as field engineer in Indiana. Two years later he was transferred to the general office, and in 1929 was appointed manager of the Highways and Municipal Bureau. Six years later, in 1935, he was appointed district manager of the New York office.

Construction Manager

HARRY C. SHIELDS has been appointed Eastern manager of the construction division of The Presstite Engineering Co., St. Louis, Mo. Mr. Shields has had 26 years' experience in the cement and construction industries. He was manager of the Technical Bureau of Pennsylvania-Dixie Cement Corp., New York, N. Y., and served as field engineer and sales manager of the Marquette Cement Manufacturing Co., Chicago, Ill. The Presstite Co. manufactures Kalktite, a cold applied sewer joint and concrete paving joint sealing compound; Enamelites for cold storage work; and waterproofing compounds.

Ideal Promotions

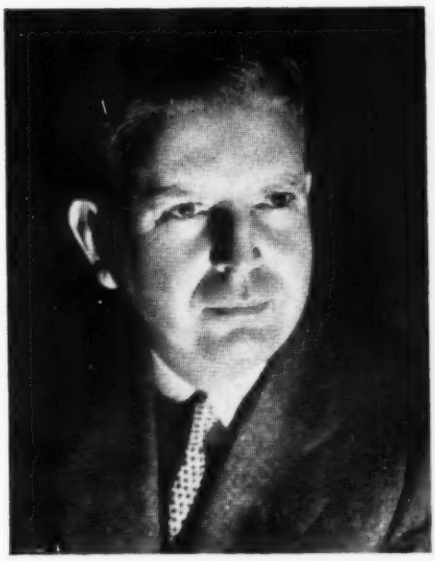
J. C. ANDREWS, division superintendent, Northern Division, Ideal Cement Co., Denver, Colo., has been appointed chief production engineer in charge of production in a technical capacity at all plants. OTIS A. BAYLESS has been promoted from chief chemist at the Ada, Okla., plant to division chief chemist of the Southern Division, where he will supervise plant laboratories at Ada, Okay, Houston and Mobile, with headquarters at Ada. He will be succeeded as Chief chemist at Ada by A. M. RUSSELL, assistant chemist. HARRY E. BORN has been made division chief chemist, Northern Division, and will supervise plant laboratories at Portland, Boettcher, Devil's Slide, Trident and Superior, with headquarters at the Boettcher plant. V. T. WILLIAMS has been promoted from division auditor of plants in the Northern Division to chief production clerk. DAVID O. HOWE, formerly project engineer at Ada, has been named project supervisor in Denver. A. W. HOOTON, formerly superintendent at the Mobile plant, has been made plant manager at Devil's Slide, Utah, and HUGH L. CONNER has been promoted from project engineer at Devil's Slide to assistant superintendent at the same plant. JOHN WOLFE, having completed his Master's Degree in Geology at the Colorado School of Mines, will be attached to the Central and Research Laboratory under Mr. Wilsnack's supervision, devoting his time exclusively to the search for cement and concrete materials.

Awarded Gold "Oscar"

W. A. WECKER, president of Marquette Cement Manufacturing Co., Chicago, Ill., in behalf of his company, was recently awarded the gold "Oscar," top award for excellence in annual reporting, for Marquette's annual report for 1947. This report was chosen from more than 4000 corporate reports by an independent board of judges in the national survey conducted annually by Financial World magazine. Donald V. Fraser, president of Missouri-Kansas-Texas Railroad, last year's winner, made the presentation.

Consulting Engineer

J. C. WITT, for the past ten years technical director of Marquette Cement manufacturing Co., Chicago, Ill., is now consulting engineer. Mr. Witt received his Ph.D degree in chemistry and physics at the University of Pittsburgh, and later was graduated in mechanical engineering at Armour Institute of Technology, subsequently receiving his professional M.E. degree. He started his career in the cement industry as technical director of the Rizal Cement Company in the Philippine Islands. Prior to joining the Marquette organization in 1938, Mr. Witt was director of research for Universal Portland Cement Co. and its successor, Universal Atlas Cement Co. His activities have included prospecting for raw materials, plant operation, experimental engineering and research. He has helped in the design of several cement plants, and has been consultant on various projects involving the manufacture and use of cement and other materials. Mr. Witt is active in the cement, concrete, and fuel committees of the American Society for Testing Materials, and is the author of "Portland Cement Technology" and of many papers published in technical journals.



J. C. Witt

Study Cement Supply

PAUL L. BOLIN, St. Paul, Minn., sales manager, Universal Atlas Cement Co., New York, N. Y., has been made a member of a six-man committee appointed recently to study the problem of the amount of cement to be allocated for homes and highways in the State of Minnesota. Other members of the committee are Thor Becken, representing a ready-mix firm; S. T. Dickinson, representing concrete block manufacturers; James W. Clark, commissioner of business research and development for the State; Stuart Rothman, state housing director; and A. J. Keffner, executive director of the St. Paul Homebuilders Association.

Inspect Gypsum Mine

MELVIN H. BAKER, president of the National Gypsum Co., Buffalo, N. Y., with a group of company officers and directors recently made a tour of the Clarence Center, N. Y. mine and plant where they viewed actual operations at close range. Directors who inspected the mine and plant were William M. Currie, Elmer E. Finck, Edwin F. Guth, Lewis G. Harriman, Joseph A. W. Iglehart and Gordon H. Tarbell. Officers included Dean D. Crandell, vice-president in charge of dealer sales; Lewis R. Sanderson, vice-president in charge of operations; and Charles E. Masters, vice-president in charge of finance.

Heads Sales Promotion

ERNEST A. HEKKING, manager of paint sales of the National Gypsum Co., Buffalo, N. Y., has been named to head a newly created sales promotion and correspondence department. C. Gustavus, manager of gypsum wall board sales, will succeed Mr. Hekking as manager of paint sales. JOE L. PHILLIPS, of the insulation sales department, has been designated to handle rock wool sales, and DAVID N. SCOTT, formerly head of the sales correspondence department, will assist him.

District Engineer

FRED R. MCCOMB, field engineer in Indiana for the Portland Cement Association, Chicago, Ill., has been appointed district engineer of the Minneapolis, Minn., office. He succeeds FRANK S. ALTMAN, who has retired after 28 years of active service with the Association. Mr. McComb joined the P.C.A. in 1936 and has been field engineer for 12 years. He spent three and one-half years as an engineer officer in the Corps of Engineers, U. S. Army, in World War II. He was retired with the rank of captain in 1946 and rejoined the Association.

Mr. Altman prior to his retirement had served as district engineer in Minneapolis since 1922, directing field promotion in the States of Minnesota and North Dakota. He joined the Association in 1920 as a field engineer in Kansas.

Association Speaker

BERNARD MANDERFIELD, superintendent of the Barberton, Ohio, limestone mine of the Columbia Chemical Division, Pittsburgh Plate Glass Co., Pittsburgh, Penn., was speaker at the recent meeting of the Purchasing Agents Association. In his speech Mr. Manderfield described the various operations of the mine.

Travelers Return

H. X. ESCHENBRENNER, president of the Universal Concrete Pipe Co., Columbus, Ohio, and his son H. E. ESCHENBRENNER, have returned from their two-month trip to Europe where they visited concrete pipe manufacturing plants in England, France, Belgium, Switzerland and Germany.

Association Secretary

W. VERNON BRUMBAUGH has been appointed executive secretary of the Refrigeration Equipment Manufacturers' Association. Mr. Brumbaugh resigned as secretary of the National Lime Association in 1945 to take a position in the trade association field, being employed by McClure, Hadden & Ortman, Inc., management engineers, Chicago, Ill.

Plant Superintendent

JOHN O. LEWIS has been appointed superintendent of the Long Beach, Calif., board plant of the Standard Gypsum Co., Oakland, Calif.

Joins Azbe Engineers

WARREN H. WEISZ has joined the technical staff of the Azbe Corporation, St. Louis, Mo. Mr. Weisz is a chemical engineer, having graduated from the University of Missouri in 1947 with a degree of B.S. in chemical engineering, and has done additional graduate work in chemical engineering since receiving his degree. During World War II he served as lieutenant in Field Artillery for three and one-half years, including 20 months overseas duty in the European theater.

Discuss "Basing Point"

VERNON W. BARLOW, sales manager, Monarch Cement Co., Humboldt, Kans., was one of the participants in a panel discussion of the "basing point" system and the effect the elimination of this system has on Kansas concerns, at the state-wide conference which was held recently in Topeka.

Sales Manager

HAROLD J. LAYDEN, formerly manager of the St. Louis sales office of the Universal Atlas Cement Co., New York, N. Y., has been named manager of the Kansas City sales area. He succeeds Winfield H. McDowell, who has retired.

Assists General Manager

LEE KNACK, consultant in industrial relations work, Fountain Sand and Gravel Co., Pueblo, Colo., has been named assistant general manager. Mr. Knack joined the company about a year ago. Prior to that he was connected with General Motors Corp.

Plant Engineer

E. B. SMITH has resigned as plant manager of Cemento Portland Nacional, S. A., Hermosillo, Son., Mexico, to accept a position as plant engineer with the Southwestern Portland Cement Co., Victorville, Calif.

General Manager

ARTHUR GILES, formerly sales manager for James W. Bell Equipment Co., Cedar Rapids, Iowa, has been appointed general manager of the Iowa Sand and Gravel Co., Gilmore City, Iowa.

Secretary-Treasurer

BILL FRASER has been appointed secretary-treasurer of the Columbia Rock Products Corp., Columbia, Tenn., according to an announcement of Carl Gilbreath, president of the company.

Elected Vice-President

COL. HARRY L. BERNO, former president of the W. H. Davey Steel Co., has been elected vice-president of the Medusa Portland Cement Co., Cleveland, Ohio. Mr. Berno left the Davey company in 1942 to enter the Army as a captain. He rose to the rank of colonel and served on the staff of British Lord Mountbatten when he was Allied commander in southeast Asia.

Busy Block Man

CHARLES G. SHRINER, president of the Cunard-Lang Concrete Co., Columbus, Ohio, is also secretary and in charge of advertising at the Walker T. Dickerson Co., manufacturers of women's shoes. He is a past secretary of the Athletic Club, a past president of the Bexley Players, a member of the Aladdin Shrine and the Columbus Country Club. Mr. Shriner instituted the Shriner Memorial Award at South High School in Columbus, which is given to the outstanding pupil of the year.

Observe Anniversary

EXECUTIVES OF MARQUETTE CEMENT MANUFACTURING CO. and United Electric Coal Companies recently observed the 10th anniversary of the first river shipment of coal from United Electric's Buckheart Mine dock at Liverpool, Ill., to the Marquette cement plant at Oglesby, Ill. Since then, 1½ million tons of coal have been transported by water between the two points.

Participants in the celebration from Marquette included; W. A. Wecker, president; R. Moyle, Sr., vice-president in charge of operations; D. S. Colburn, vice president; V. M. Hanley, secretary and treasurer; L. W. Saxby, assistant to the president; Frank Moyle, director of operations; V. A. Kogge, water transportation division manager; C. M. Tuttle, traffic manager; and J. K. White, director of public relations.

Joins Equipment Firm

RALPH H. NOLAN, formerly president and treasurer of the Nolan Stone Co., Inc., Rome, N. Y., has been appointed executive vice-president and treasurer of the Credle Equipment Co., Utica, N. Y. Mr. Nolan recently sold the quarry at Prospect, N. Y., to the Eastern Rock Products Co.

Committee Chairman

JOHN C. BEST, vice-president of the National Gypsum Co., Buffalo, N. Y., has been appointed chairman of the International Affairs Committee of the Buffalo Chamber of Commerce.

Stone Company Sold

LANWEHR STONE CO., Ottawa, Ohio, has been sold by Alva Lanwehr and Albert Schumacher to Jim Shroyer, owner of the Auglaize Stone Co., Defiance, Ohio.

Manager of Sales

ANSEL T. ROGERS has been appointed New York manager of sales engineering for the Lehigh Materials Co., Lansford, Penn., a wholly-owned subsidiary, Lehigh Navigation Coal Co., formed to manufacture Lelite, a lightweight aggregate.

OBITUARIES

F. L. JAEGER, who was vice-president of the Marquette Cement Manufacturing Co., Chicago, Ill., until his retirement in 1943, died November 14. He was 70 years of age. Mr. Jaeger was widely known throughout the industry, and had been with the company for 30 years, starting as salesman, becoming sales manager and later vice-president.

CLINTON R. BREWER, concrete block manufacturer, Charleston, Ill., passed away November 3 at the age of 69.

SAM F. PACE, a director of The Diamond Portland Cement Co., Middle Branch, Ohio, was killed recently when the car he was driving was hit by a Pennsylvania Railroad passenger train near Alliance, Ohio. Mr. Pace was also president of the Ohio Contractors' Association and Asphalt Hot Mix Association of Ohio.

FRANK J. GRISWOLD, one of the founders of the American Gypsum Co., Port Clinton, Ohio, died suddenly on October 28, after a long illness. He was 80 years old. Mr. Griswold retired in 1929 as vice-president and general manager of the plant, which later became a division of the Celotex Corp. He had been in the gypsum and plaster business in Iowa before going to Port Clinton.

F. BERNARD KITCHIN, operator of a stone quarry at Greenburg, Ind., until 14 years ago, died October 26 at Santa Monica, Calif. He was 55 years old.

JACOB BARAB, consulting engineer of Avondale, Penn., died October 9 at Atlantic City, N. J. He had been associated with the Hercules Powder Co., Wilmington, Del., for 22 years before he organized the Kelbar Powder Co., Avondale, in 1939. He has been a consulting engineer in New York City and Lakeland, Fla., since 1945. Mr. Barab has been author of various articles in ROCK PRODUCTS on scientific blasting.

DAVID H. MACFARLAND, who was vice-president of the Medusa Portland Cement Co., Cleveland, Ohio, until his retirement six years ago, died October 5 at the age of 76. Mr. MacFarland had been associated with the cement industry for many years. Prior to his association with Medusa he served as assistant to the president of the Atlas Portland Cement Co., New York, N. Y.

HARRY VERNON MASON, a chemist for the Pittsburgh Limestone Co., West Middlesex, Penn., for 25 years, died October 16 at the age of 60.

EDWARD P. RUSH, president of the Rush Concrete Products Co., Cincinnati, Ohio, which he founded three years ago, died October 15. He was 58 years old.

EUGENE T. SCOTT, former sales manager of Templeton, Kenly & Co., Chicago, Ill., died recently at his home in Hinsdale, Ill. He was 35 years old. Ill health caused Mr. Scott's retirement from active duty with the company early in 1948 although he had continued to serve on the board of directors.

FRANK H. KILBOURN, a founder of the Owens Sound Cement Co., Owens Sound, Ont., Canada, died October 19 at the age of 84. His company was one of the firms involved in the Canada Cement Company merger in 1909.

EDWARD B. YANCEY, a vice-president and member of the board of directors and of the executive committee of E. I. du Pont de Nemours & Co., Wilmington, Del., died October 24. He was 60 years of age.

FLEMING FONTAINE FREEMAN, founder and operator of the Lily White Lime Co., Cross Hollows, Ark., for many years, died October 8, following a long illness. He was 81 years old.

T. F. ROBINSON, superintendent of the Beachville lime plant of Gypsum, Lime and Alabastine, Canada, Ltd., Toronto, died suddenly at his home in Woodstock, Ont., on October 21. He was 82 years old. Mr. Robinson had spent practically all his life in the gypsum and lime industries, starting in 1890 with the United States Gypsum Co. at the gypsum plant in Alabaster, Mich., where he remained for 30 years. The next 30 years he spent in Canada working for the Gypsum, Lime and Alabastine Co. The first six years he was superintendent of the dolomite finishing lime plant at Elora; then transferred to Montreal where he erected and operated a gypsum plaster mill and board plant, and for the last 20 years has been superintendent of the high calcium lime plant at Beachville. Two of his sons are also associated with the company; Jack Robinson, general superintendent, is in charge of the lime plants, and Leo Robinson is in charge of the gypsum plants. Mr. Robinson was an enthusiastic sportsman, particularly deer hunting, and was planning on going again with his boys this year. An article on Mr. Robinson entitled "The Plant Superintendent" appeared in the April, 1939, issue of ROCK PRODUCTS.

Reopens Quarry

BUTLER'S BLUFF QUARRY, near Noel, Mo., has been reopened under the management of C. D. Wyatt.

Announce Winners in N.R.M.C.A. Safety Contest

RESULTS of the 1948 Safety Contest conducted by the National Ready Mixed Concrete Association, Washington, D. C., have been announced. Winning company in Class A (companies producing more than 40,000-cu. yds. of concrete during the contest period from July 1, 1947 to June 30, 1948) is Lubbock Building Products Co., Lubbock, Texas, which had no injuries to employees or to non-employees and which had only one property damage accident during the contest period. Eberts Brothers Co., Wyandotte, Mich., had the same record, however combined total of yards produced and man-hours worked was less.

Winning company in Class B competition (companies producing 40,000-cu. yds. of concrete or less during the contest period) was Pocahontas, Inc., Salisbury, Md., which had an accident-free record during the contest period. Nine other companies in Class B competition also had accident-free records and are entitled to honorable mention. They are: Mesaba Construction Co., Hibbing, Minn.; Grand Junction Building Materials Co., Inc., Grand Junction, Colo.; The Trumbower Co., Inc., Nazareth, Penn.; Builders Concrete Co., Clinton, Okla.; J. H. Beers, Bangor, Penn.; Certified Ready Mix Concrete Co., Keokuk, Iowa; Vineyard Redi-Mix Concrete Co., Vineyard Haven, Mass.; Grand Haven Ready-Mix Concrete Co., Grand Haven, Mich.; and Monroe Ready Mix & Material Co., Monroe, Wis.

Ninety-one companies submitted reports in the 1948 contest, compared with 73 companies last year. These 91 companies produced 7,637,368-cu. yds. of concrete during the 12-month period ended June 30, 1948, representing approximately 40 percent of the concrete produced by member companies during that period. Trophies will be presented to the two winning companies by the magazine *Pit and Quarry*.

Gypsum Company Story

THE STORY of National Gypsum Co., Buffalo, N. Y., is being told in a new illustrated booklet, "Hitch Your Wagon to a Star," being distributed by the *Saturday Evening Post*. Contents describe the company's beginning in the building material industry.

Annual Lime Conference

THE ANNUAL LIME CONFERENCE of the Department of Agronomy, Ohio State University and the Ohio Agricultural Experiment Station, with members of the limestone industry, was held December 10, 1948, in the State Office Building, Columbus, Ohio.

More footage Drilled

...less upkeep cost

When you protect drills from rust and wear with Texaco Rock Drill Lubricants EP

YOU take rust and wear out of the category of major "headaches" when you protect your drills with *Texaco Rock Drill Lubricants EP*. At the same time, you assure more trouble-free operation (which means more footage per shift) . . . longer drill life . . . lower maintenance costs.

Texaco Rock Drill Lubricants EP have the "extreme pressure" characteristics necessary to protect moving parts against wear under the severest conditions. Furthermore, they resist washoff . . . stay fluid at low temperatures . . . keep parts free of gum and carbon formations . . . and guard against rust whether drills are running or idle.

Texaco Rock Drill Lubricants EP meet the specifications of leading rock drill manufacturers. Use the viscosities recommended for your particular drills and operating conditions.

For greater efficiency in *compressor* operation . . . for free rings, clean valves, clear airlines . . . use the recommended *Texaco Cetus, Alcaid or Algol Oils.*

Let a Texaco Lubrication Engineer help you increase drilling efficiency and economy. Call the nearest of the more than 2300 Texaco Wholesale Distributing Plants in the 48 States, or write:

The Texas Company, 135 East 42nd Street, New York 17, New York.

TEXACO

TEXACO Lubricants and Fuels

Tune in . . . TEXACO STAR THEATRE presents MILTON BERLE every Wednesday night. METROPOLITAN OPERA broadcasts every Saturday afternoon.

INDUSTRY News

Opens Rock Wool Plant

SUN VALLEY MANUFACTURING CORPORATION, Phoenix, Ariz., manufacturer of Stawhite, a chlorine cleaner and disinfectant, has started production of rock wool. The new plant, an all steel structure completed at a cost of $85,000, will produce 30 tons of the finished product daily.

The rock wool is manufactured from slag obtained from the Magma smelter, Superior; crushed basalt boulders from hills surrounding Phoenix; and limestone from the Superior area. Paul Rist is president of the company; Paul Hopkins, vice-president and secretary; and F. C. Ramsing, general manager.

Sand Company Sold

BERNARD P. MCDONOUGH, McDonough Construction Co., has contracted to purchase the Kanawha Sand Co., Parkersburg, W. Va., from Samuel Logan and other stockholders for a sum of approximately $300,000, it is reported. The company, in operation for about 25 years, handles road construction and building materials. W. T. Stump and Burton H. Bostwick will remain as plant manager and company secretary, respectively. The sale also includes frontage on the Ohio river, shore installations, and a fleet of 11 barges, two dredges, and miscellaneous floating equipment.

Adds Phosphate Service

RIDDLE QUARRIES, Marion, Kan., producer of agricultural lime, and road stone and building rock, has secured the agency for powdered rock phosphate for the four-county area of Marion, Chase, McPherson and Rice counties. John Riddle, manager, stated that the new product will be handled either in 100 lb. bags at the plant, be delivered in bags to the farm, or be spread on the land, by the company's fleet of trucks.

Close Gypsum Mine

NATIONAL GYPSUM CO. has taken the last ton of rock from its mine at Akron, N. Y., and is currently removing crushers, pumps, tracks, locomotives and other equipment. The mine, 70-ft. deep and three miles long, had been in operation over 40 years, and a total of 3,438,710 tons of gypsum rock have been taken out. The gypsum processing plant on the site will continue to operate, receiving its raw materials from the company's Clarence Center, N. Y., mine. Akron personnel will be allocated between the two plants and the Clarence Center mine.

Safety Program

IOLA, KANSAS, PLANT, Lehigh Portland Cement Co., has placed a new safety idea into operation. When a safety violation is observed, the offender is given a written warning. A second violation will result in the offender's being summoned before the safety committee for such action as it considers merited. Each foreman carries a pad of notices, serves the original on the offender, turns in a copy to safety headquarters, and keeps a copy for himself.

New Freight Increase?

CLASS I RAILROADS in the United States have asked the Interstate Commerce Commission to grant an additional increase of 13 percent in rates on all commodities, including sand and gravel, crushed stone and slag. No maximum in flat cents per ton was proposed although such a maximum was proposed and granted in Ex Parte 166. The new application of the carriers has been accepted by the Commission and hearings have been ordered. The new proceeding will be known as Ex Parte 168. The National Sand and Gravel Association, Washington, D. C., on behalf of the sand and gravel industry, has announced plans to present testimony and exhibits in opposition to any increase.

Erects Mica Mill

NATIONAL GRINDING CORP. has secured a permit to erect a $3000 mica mill on the Denver and Rio Grande railroad right of way at Lawrence, Colo. The permit covers the cost of foundations for the mill. Mica to be handled probably will be from mines being developed between Grand Junction and Glade Park, Colo.

Crushing Plant Burns

HEISEY BROTHERS QUARRY, Rheems, Penn., lost a two-story stone crushing plant in a recent fire which was said to have started in an electrical control panel. The fire spread to a tank containing 800 gal. of asphalt. Loss was estimated at $60,000.

Plan Expansion of State Cement Plant

SOUTH DAKOTA Legislature will be asked to approve the issuance of $1,500,000 in revenue bonds by the state-owned cement plant when it meets next January, according to J. D. Davenport, chairman of the cement plant commission. Proceeds from the sale of bonds would be used to make improvements and expansions that will double plant capacity.

A.L.I. Exhibit

AGRICULTURAL LIMESTONE INSTITUTE again presented an educational exhibit at the National Farm Show, held November 27—December 4, 1948, at the Coliseum, Chicago, Ill. The following committee was in charge: H. A. Clark, chairman, Consumers Co., Chicago, Ill.; J. L. Fay, Material Service Corp., Chicago, Ill.; P. E. Heim, Carbon Limestone Co., Youngstown, Ohio; W. E. Hewitt, East St. Louis Stone Co., East St. Louis, Ill.; S. P. Moore, Concrete Materials & Construction Co., Cedar Rapids, Iowa; and A. B. Rodes, Franklin Limestone Co., Nashville, Tenn.

Heavy Stone Shipments

BIG ROCK STONE & MATERIAL CO., Little Rock, Ark., is removing stone from 200-ft. high "Big Rock" at the rate of 100 50-ton railroad carloads per day, Snow Wilson, head of the company, has announced. Mr. Wilson estimates that the company's 48 acres of the mountain contain enough available stone to assure 80 more years of operation.

Adds 24 Silos for Storage

MEDUSA PORTLAND CEMENT CO., Cleveland, Ohio, which has an improvement program of $1,000,000 under way at its Wampum, Penn., plant, announces completion of 24 new silos. The new silos are 105 ft. high and 27 ft. in dia. and are constructed with reinforced concrete. Total storage capacity of the plant is now 400,000 bbl.

Moves to New Quarters

VERMICULITE INSTITUTE has announced removal of its offices from 2540 Eastwood Avenue, Evanston, Ill., to 208 South La Salle Street, Chicago 4, Ill.

Limestone Companies Sponsor Broadcasts

FOUR LIMESTONE PRODUCERS in southwest Missouri, George M. Baker of Lockwood, Carthage Marble Corp. of Carthage, Independent Gravel Co. of Joplin, and Southwest Lime Co. of Neosho, have started a joint radio program over station KDMO, Carthage. The firms have contracted for a series of daily one-minute spot announcements and are also sponsoring a weekly half-hour Farm Forum produced by vocational agricultural teachers, county agents, and other agricultural specialists. Negotiations are under way between a group of northwest Missouri producers and station KFEQ, St. Joseph, for a similar type of service in that area.

Engineering Positions Open

FIELD POSITIONS as mining engineers with the Bureau of Mines, United States Department of the Interior, are now open in coal, metallic, and nonmetallic minerals fields, James Boyd, Bureau Director, has announced. Applications for these jobs, with starting salaries ranging from $3727 to $6235 per year, are being accepted by the U. S. Civil Service Commission, Washington 25, D. C. Selections for appointment will be made on the basis of the applicant's experience, education, and training as shown on his application form and by corroborating evidence.

Pavement Yardage

AWARDS of portland cement concrete pavement for the month of October and for the first ten months of 1948 have been announced by the Portland Cement Association as follows:

	Square Yards Awarded During Oct., 1948	During 1st 10 mos., 1948
Roads	1,343,508	20,984,792
Streets and alleys	1,262,845	16,674,333
Airports	301,212	2,297,973
Total	2,907,565	39,957,098

Soil Cement Exhibit

PERMANENTE CEMENT CO. served as host at the recent Santa Clara County Fair held at San Jose, Calif. The company exhibit featured soil cement, showing how farmers could put a durable hard-top of soil cement on their corrals, feed lots, or barns at exceptionally low cost.

Correction

ON PAGE 104 of our September, 1948, issue we inadvertently published a news item to the effect that J. B. Vincent had announced plans to manufacture Permalite, which is a tradename for vermiculite, at Henderson, Nev. The Great Lakes Carbon Corporation of New York, N. Y., advises that it is owner of the trademark, Permalite, which is registered in the U. S. Patent Office, and that it is currently applying this mark to lightweight aggregates and related products.

Granted Gravel Contract

NORTHWESTERN ENGINEERING CORP., has been awarded a $265,700 contract by the City of Denver, Colo., for 232,000 tons of gravel for use in street paving and oiling during the next two years, Thomas P. Campbell, manager of improvements and parks, announced.

Plant Expansion

LEHIGH PORTLAND CEMENT CO. has been granted a building permit to erect an office and storage building at its plant in Buffalo, N. Y.

Glass Sand in Kansas

KANSAS Industrial Development Commission and State Geological Survey will conduct an investigation of a deposit of glass sand located ed in Barber county. According to George B. Weeks of the Commission, the sand definitely has "potentialities." Up to this time the state has never produced sand suitable for glass-making in paying quantities.

Cement for Memorial

PERMANENTE CEMENT CO., Permanente, Calif., recently donated cement for a 50-ft. statue "Peace" which has been given to the City of Santa Clara, Calif., by sculptor Benny Bufano. The Permanente product was used for the base supporting the stainless steel and redwood memorial.

Coming Conventions

January 10-14, 1949—
Materials Handling Exposition, Convention Hall, Philadelphia, Penn.

January 16-20, 1949—
Associated Equipment Distributors, Annual Meeting, Stevens Hotel, Chicago, Ill.

January 18-20, 1949—
National Agricultural Limestone Association, Inc., 4th Annual Meeting, Washington, D. C.

January 20-21, 1949—
Wisconsin Concrete Products Association, 29th Annual Convention, Pfister Hotel, Milwaukee, Wis.

Jan. 31-Feb. 3, 1949—
National Concrete Masonry Association, 29th Annual Convention and Concrete Industries Exposition, Cleveland Public Auditorium, Cleveland, Ohio.

February 7-9, 1949—
National Crushed Stone Association, 32nd Annual Convention, Hotel New Yorker, New York, N. Y. There will be no exhibit.

February 13-17, 1949—
American Institute of Mining and Metallurgical Engineers, Annual Meeting, San Francisco, Calif.

February 14-18, 1949—
National Ready Mixed Concrete Association, 19th Annual Convention, Hotel New Yorker, New York, N. Y. There will be no exhibit.

February 14-18, 1949—
National Sand and Gravel Association, 33rd Annual Convention, Hotel New Yorker, New York, N. Y. There will be no exhibit.

February 21-22, 1949—
Agricultural Limestone Institute, 4th Annual Convention, Edgewater Beach Hotel, Chicago, Ill.

February 22-25, 1949—
American Concrete Institute, 45th Annual Convention, Hotel Pennsylvania, New York, N. Y.

Feb. 28-March 4, 1949—
American Society for Testing Materials, Spring Meeting and A.S.T.M. Committee Week, Edgewater Beach Hotel, Chicago, Ill.

1949 Agricultural Conservation Program

AGRICULTURAL LIMESTONE INSTITUTE has announced that the 1949 Agricultural Conservation Program will be operated along the same lines as previous programs, applying to land located in the Continental United States, Alaska, Hawaii, Puerto Rico, and the Virgin Islands. It does not apply to any department or bureau of the United States Government, corporation wholly owned by the United States, or to certain grazing lands owned by the United States.

Funds have been allocated (subject to an appropriation of $262,500,000) to the various states on the basis of their conservation needs. In accordance with the provisions of Public Law No. 712, the proportion allocated to any state has not been reduced more than 15 percent from its proportionate 1946 distribution.

Speed Action for Cement Plant

SAMUEL GUIBERSON, Texas oil millionaire who recently announced plans to construct a cement plant at Palm Springs, Calif., has had to halt activities temporarily on action of Riverside County that Palm Springs is a recreational area. Mr. Guiberson has filed a plea for an injunction against the county's action, and William C. Dixon, special assistant to Attorney General Tom Clark, filed a petition in Federal District Court, Los Angeles, asking for fast action on the plea. According to Dixon, with the cement shortage hampering housing construction, speed will be in the public interest.

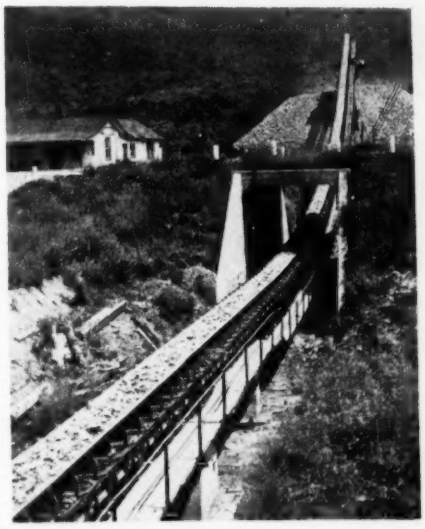
Four-Flight Conveyor Transports Limestone

BLUE RIDGE STONE CORP. is making use of a four-flight conveyor to transport limestone near Roanoke, Va., at the rate of 350 t.p.h. The belt system transports crushed limestone from the quarry a three-quarters of a mile to the processing plant. The stone is being used as highway building material and ballast for railroads.

A permanent installation, the belt conveyor, designed by mechanical goods engineers of Goodyear Tire & Rubber Co., Akron, Ohio, replaces six railroad engines which for years negotiated a six percent grade, requiring six miles of track. In addition to providing speedier and more efficient operation, the belt system maintains a stockpile 24 hrs. ahead of finishing plant needs, according to Abney Boxley, vice-president of the Blue Ridge Stone Corp.

First three flights of the system haul stone to the stockpile and the fourth flight delivers from the stockpile to plant. No. 1 belt operates in a tunnel under the quarry floor and receives 10-in. stone from the primary crusher, which it elevates 57 ft. to the secondary crusher. Here the load transfers to the second conveyor, which travels 1300 ft., spans a work road, and elevates 55 ft. to the quarry rim to discharge onto flight No. 3. The third belt passes under U. S. Highway 460 before discharging to a 70 ft. high stockpile. The last belt, flight No. 4, operates in a tunnel under the stockpile and receives its load from a remote-controlled feeder gate. Length of this conveyor is 1600 ft.

The primary belt is 42-in. wide, the other three are 30-in. The system is powered by three 50- and one 40-hp. motors. Idlers, structure and machinery for the system were supplied by Barber-Greene Co. At the quarry working face, 200-ft. high, two steam shovels are used to load blasted rock into four dump trucks which feed the primary crusher.



Flight No. 3 tunnels under U. S. Highway 460 and rises at an 18 deg. angle to dump over 70-ft. high surge pile

Looking back along Flight No. 4 starting 1600-ft. trip from beneath surge pile to finishing plant. Flight No. 3 in background

Flight No. 2 runs 1300-ft. across quarry floor, spans a work road, and lifts the stone in a vertical curve, 55-ft., delivering to the third belt at the rate of 350 t.p.h.

HINTS and HELPS

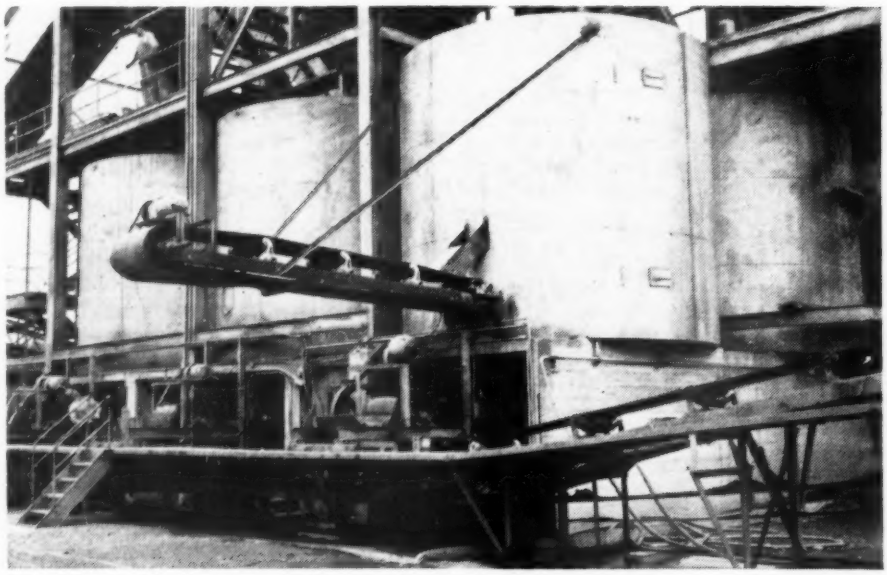
PROFIT-MAKING IDEAS DEVELOPED BY OPERATING MEN

Screen Washing Nozzles

SUCCESSFUL crushed stone operators seem to agree that plenty of water should be used in washing aggregate. The W. S. Tyler screen, shown in the illustrations, has five headers with six nozzles per header, or a total of 30 nozzles. Just below this screen is another for finer sizes that has four headers with a total of 19 nozzles. All nozzles are ¾-in. pipe slightly flattened and a high velocity of water is used. These particular screens are being used at a crushed granite operation where stone at the outset is practically clean. Plant capacity is some 250 tons per hr.

Screen with five headers each containing a total of six nozzles

Screen with four headers and total of 19 nozzles. Screens are being used at a granite operation where stone is clean at outset



Loading belt gives added flexibility to tank

Flexible Conveyor System

AN AUXILIARY truck loading conveyor is used in addition to a flexible conveying-blending system employed at the new sand and gravel plant of the Pacific Building Materials Co., Portland, Ore. Nine steel silos, each 16- x 16-ft., are arranged in three rows of three tanks each. Washed and graded aggregate fall to these bins. Under each row is a reversible, 24-in. belt conveyor that can deliver agregate to (1) a radial stockpiler, (2) the ready mix batching plant, (3) truck loading bins and (4) dock barge loading facilities. The auxiliary truck loading conveyor is welded to one of the outside bins as shown in the illustration. The new plant, one of the first installations of its kind in the West, features the use of Dorr Co. sand sizers.

Pipe and Valve Clear Water from Mine

A NOVEL METHOD was employed recently by the Gouverneur Talc Company to clear water from an old mine, at Gouverneur, N. Y. Instead of usual pumping operations characteristic of such work, a 4-in. pipe was driven directly into the wall of the mine level which had been dug out. A large valve was attached to the pipe, and a hole drilled into the wall through the pipe until penetration was made into the mine. Pressure from the quantity of water in the old mine was sufficient to force water through the opening into the 4-in. pipe and up the shaft. The valve was inserted so that the water could be shut off before the piping was completed and at the same time prevented flooding of the shaft and mine entrance level.

Homemade Ore Dryers

SEVERAL SMALL Western mills have a wet, low grade concentrate that must be dried and then brought to a higher concentration by further treatment. Several types of dryers have been evolved for this work that can be made in a mill shop from materials on hand.

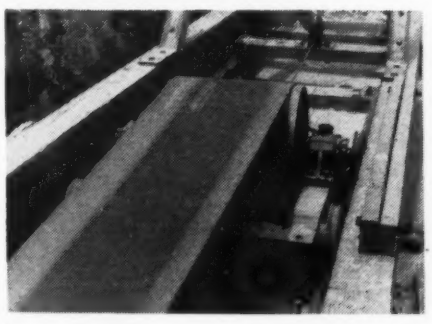
A simple type of dryer is made from a 50-gal. drum, about 25-sq. ft. of ¼-in. plate, and some lengths of 2- or 3-in. pipe. This dryer can be constructed in about 4 hours. Feed to the dryer is usually a non-caking material which is all minus 10 mesh and 30 percent minus 150 mesh. To construct this apparatus a rectangular cone is cut and welded. The top of a 50-gal. drum is cut to receive the cone and exhaust pipe. An additional hole is cut near the bottom of the drum for a lighting hole. The oil line is placed so that the fuel drips into a 4- to 6-in. steel basin welded in the bottom of the drum. Several pipes, 2- or 3-in. in dia. are often suspended down into the cone to allow steam from the drying ore to escape freely.

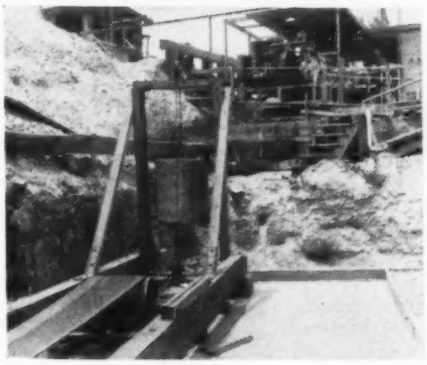
A second type of dryer uses a blast burner and two cones which are surrounded by fire-brick and 12-gauge iron walls. This type dryer is efficient and can dry two different types of material that must be kept separate at the same time. Coils installed in this type dryer generate steam for mixing flotation reagents, heating the mill, or other general uses.

Reclaiming System for Silica Sand

THE METHOD of reclaiming sand is a feature at the new silica plant of the Nevada Silica Sands, Inc., Overton, Nev. Final washed sands are piled on a concrete slab, 60- x 200-ft. long, on top of which has been placed an 18-in. layer of gravel. The wet sands drain through this material and are reclaimed by a scraper that delivers to a hopper straddling a horizontal conveyor belt. Details of this installation are shown in the illustrations.

Extra carrier rolls have been placed at three different locations along the belt and the traveling hopper normally loads over one of these spots. The tail pulley assembly is mounted on four grooved wheels that ride a track with tension being supplied by a cylindrical concrete counter-weight. The conveyor belt delivers to a cross belt serving the oil-fired rotary dryer that has a cooler as an auxiliary unit. The dry sand is then elevated to steel bins over the railroad track.





Details of reclaiming belt installation. (Top) Extra carrier rolls where hopper loads (Center) Ground pulleys keep tail assembly in line (Bottom) Concrete block maintains tension on belt

Plant of Corbetta Construction Co. with paver directly below overhead bins. Boom from paver extends left with concrete bucket at right hand corner of shed. Note truck receiving concrete from 11-cu. yd. hopper, extreme left

Paver Loads Ready-Mix

AN INTERESTING means of loading air-entrained, pre-mixed concrete to non-agitating type delivery equipment has been worked out by Corbetta Construction Co., Chicago and New York, through use of a paver manufactured by Foote Co., Inc. Drum of the paver is charged with 1-1/10 cu. yd. of concrete materials from overhead weighbatchers. The concrete is dumped from the drum to a bucket traveling on the paver distribution boom which is slightly inclined to the top of an 11-cu. yd. truck hopper.

Length of this boom is 50-ft., and is reported to be the longest ever applied on a paver. The boom is permanently anchored by guy wires to the overhead bin structure above the paver. Pre-mixed concrete is discharged to the truck below through a clamshell gate. Concrete delivery trucks used at this installation have 5-cu. yd. Dumpcrete bodies that have been built up from 4-cu. yd. capacity by the addition of a 12-in. strip of sheet steel welded around the top.

Aggregate Testing by Colorimetric Method

PAUL C. ZIEMKE, Oak Ridge, Tenn., suggests a method for determining the amount of vegetable matter in concrete sand that requires a minimum of time and equipment. A 3 percent solution of caustic soda (1 oz. sodium hydroxide, household lye, to a quart of water) is used to fill a 12 oz. graduated beaker that has previously been filled to the 4½-oz. mark with a sample of the sand to be tested.

After the solution is added to the sand, the beaker should be shaken vigorously; after which agitation the sample should be allowed to stand 24-hrs. At the end of this period, the color of the liquid above the sand indicates the amount of vegetable matter in the aggregate: colorless liquid—sand free from impurities; straw color — slight impurities, but should still pass government specifications; dark colors indicate the presence of sufficient impurities to require washing the sand or perhaps resorting to chemical treatment in order to remove vegetable matter.

Spot Charger Saves Mileage

LOCATION OF SPOT CHARGERS throughout the plant saves time and money over a central charging station from several aspects. Depending on the size of the plant, it saves the operator's time, machine working time, congestion and mileage over a central charger. These spot chargers can be located at advantageous points as indicated in the illustration. These small chargers are manufactured by several well known electrical equipment makers.

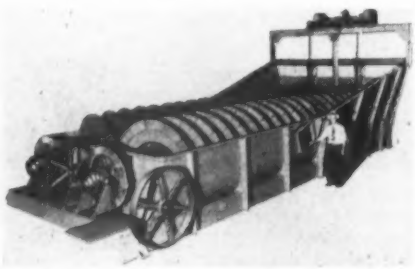
Spot charger station that eliminates large, congested central charging stations

New Machinery

ROCK PRODUCTS

Large Spiral Classifier

COLORADO IRON WORKS, Denver, Colo., recently completed what is said to be the largest spiral, submerged classifier of this type ever built. This



Spiral classifier rated at 200 long tons per hour

classifier is capable of raking over 200 long tons of product per hour. The tank is 31-ft. long and each of the 66-in. diameter spirals weighs 8½-tons. It has been built for the Davison Chemical Corp., Pauway No. 4 phosphate plant, Lakeland, Fla.

Small Churn Drill

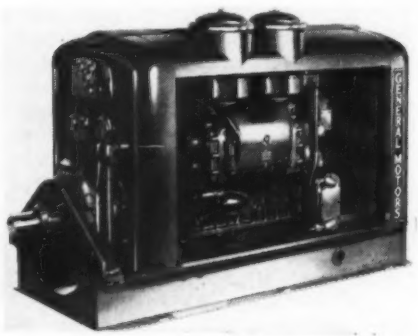
SANDERSON CYCLONE DRILL CO., Orrville, Ohio, is now in production of its new No. 1000 blast hole drill which is designed primarily for smaller quarries and portable plants.

Churn drill specially designed for smaller quarries and portable units

The drill is capable of handling 200 lb. of tools and is recommended for 5⅝- to 7-in. diameter holes. It is self-propelled and fully traction-mounted on 12-in. treads that measure 10 ft. 6 in. in length. This drill is equipped with power derrick hoist, worm feed, large working platform, and weighs 17,400 lb.

Torque Converter

DETROIT DIESEL ENGINE DIVISION, General Motors Corporation, Detroit, Mich., is now producing a torque converter and fluid coupling unit specifically engineered to the General Motors Series 71 2-cycle diesel engine, making the first complete engine and torque converter combination power



Combination Diesel engine, torque converter and fluid coupling unit rated at 153 b.h.p. at 1800 r.p.m.

unit available from one manufacturer. Consisting of four major elements—a pump, turbine, and two stators—the unit produces torque multiplication of up to 4 to one. The complete integrated power plant occupies no more space than the same engine equipped with the conventional clutch and power take-off. It is anticipated the unit will find considerable use in excavating and hoisting machines where extremely high torque is required for digging and lifting operations.

Outstanding characteristics of the torque converter and fluid coupling unit are its ability to pick up load with maximum lifting power and shift automatically from torque converter to fluid coupling principal in the higher speed range.

Heavy-Duty Coupling

LOVEJOY FLEXIBLE COUPLING CO., Chicago, Ill., announces a new line of heavy-duty flexible couplings especially designed for d.c. mill motors of the new standards adopted by the

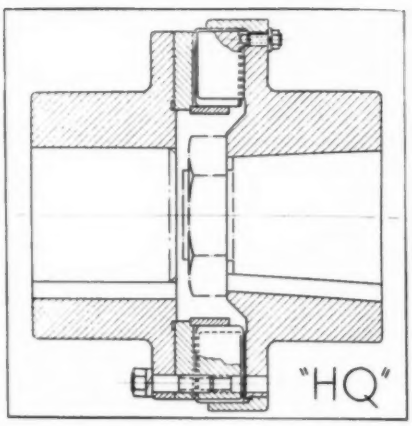


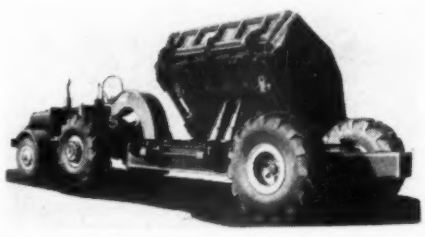
Diagram of coupling for d.c. mill motors

Association of Iron and Steel Engineers. The new coupling bodies are manufactured from electric steel castings.

Type HQ is adapted to heavy mill duties where radial removability is required, in that it is one body, split and bolted together. By reversing the jaw ring of the split body, it may be quickly detached from its adapter and secured to the solid body without disturbance of the cushions. This design is reported to permit free radial removal of either of the shafts.

Side Dump Trailer

EUCLID ROAD MACHINERY CO., Cleveland, Ohio, has recently added a side-dump trailer to its line of off-the-highway earthmoving equipment. This new unit, of welded construction, has a struck capacity of 13-cu. yd. Down-folding side gates open automatically when the body is raised. Either right or left dumping may be selected by the operator according to job requirements. This new trailer is drawn by a Euclid tractor which is powered by a 200-hp. diesel engine, with a top speed of 33.4 m.p.h., loaded. An advantage claimed for this unit is its ability to dump over bank or edge of fill while still in motion.



Side-dump trailer discharges right or left at option of operator

Air Conditioner for Cranes

DRAVO CORP., Pittsburgh, Penn., now offers a small air conditioning unit designed to protect crane operators against excessive heat, dust or noxious fumes in plants producing cement, manganese, glass, or other similar products. The unit is designed to provide summer cooling, winter heating and continuous ventilation, as well as the removal of dirt, dust, fumes and odors from the air discharged into the crane cab. About half the size of the C-5 model designed to condition the cabs of cranes operating in extremely high temperatures, the new unit is vertical and can be mounted on the side of the crane cab or on adjoining catwalks. A power line is the only requisite for its installation.

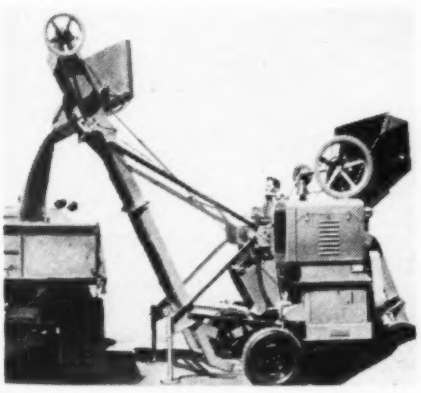
"Cold" Rubber

GATES RUBBER CO., Denver, Colo., has participated with Copolymer Corporation in the development of "cold" rubber. By cold-processing at temperatures of 41 deg. down to 0 deg., as against the 122 deg. previously required, a greatly increased control over the molecular structure of this synthetic rubber is obtained, resulting in a product which tests prove withstands abrasion fully 30 percent longer than the best natural rubber, according to C. H. Mingle, director of specialized research for the company. This greater resistance to abrasion lengthens the service life of tires, V-belts, industrial hose, impellers, and pump cases.

Bituminous Mix-Truck Loader

KWIK-MIX CO., Port Washington, Wis., subsidiary of Koehring Co., Milwaukee, has developed a special tower attachment for discharging bituminous mix above ground level. Adaptable to either the 10- or 14-cu. ft. standard mixer with a discharge height of 7¾- and 8¾-ft. respectively, the attachment answers the problem of loading the mix to trucks or piles for ground level storage.

Operated by a special hoist mounted within the mixer frame and powered by the mixer engine, the loader is controlled by a single lever located on the operator's platform. When the bucket reaches discharge position, the hoist clutch is automatically disengaged.



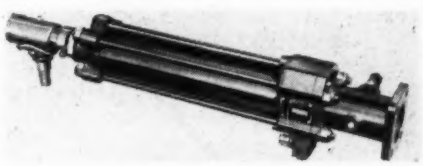
Special tower attachment for discharging bituminous mix above ground level

Road Sander Unit

HIGHWAY SAFETY APPLIANCE, INC., announces a new road sander unit for individual truck installation, insuring more dependable brick, stone and cement delivery on icy winter roads. The road sander is designed to deposit grit before the driving wheels of cars and trucks for safer stops and skid control, and to provide instant traction whenever needed. A dash-mounted switch electrically operates solenoid valves in the twin grip hoppers installed on a vehicle chassis over the wheels that releases a specially prepared grit.

Steering Booster

VICKERS INC., division of The Sperry Corp., Detroit, Mich., offers a redesigned steering booster to operators of heavy trucks and other earth moving equipment. This booster is comprised of a double-acting hydraulic cylinder with an integral control valve, relief valve and check valve. An engine-driven vane type pump develops the necessary hydraulic pressure which is proportional to the steering thrust requirement. Normally the operating pressure is low but the maximum continuous duty rating of 1000 p.s.i. is said to allow a wide service safety factor.



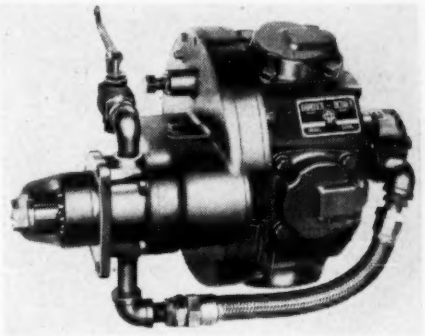
Redesigned steering booster adapted to earth moving equipment

Adjustable Safety Hat

E. D. BULLARD CO., San Francisco, Calif., has announced the "Hard Boiled" safety hat for workers, that is said to be resilient, water-proof, and a non-conductor. Only one size hat is stocked as the headbands are quickly adjustable to head sizes from 6 ⅝ to 7 ⅝. When old hats are reissued to new men, all that is necessary is to put in a new and inexpensive head band.

Announce Air Starter Line

GARDNER-DENVER CO., Quincy, Ill., announces a new line of air starters for gas, gasoline or Diesel engines, with a range of 3- to 15-hp. included in five stock sizes. According to company officials the high torque characteristic of the piston type motor is desirable for Diesel applications involving high starting loads. The 5-cylinder radial design provides even torque through the operating cycle. A feature of these starters is an air actuated pinion which, when the air valve is open, automatically engages the ring gear a split second before the starter begins to crank the engine, thus assuring positive engagement.



Starter with air actuated pinion

Low Hydrogen Electrode

AIR REDUCTION SALES CO., New York City, has developed a new low-hydrogen type coated electrode designed to prevent bead cracking in weld deposits. According to the manufacturer, this new electrode is one of the few of its type available today which operates on either a.c. or d.c., and is rated to give welds of 100,000 p.s.i. The new electrode will be known as Airco No. 394.

Air-Powered Generator

INGERSOLL-RAND CO., Phillipsburg, N. J., has brought out a lightweight air-powered generator, known as AL-150 Airlite. It will supply ample power to operate two 75 watt, 115-volt bulbs. This unit offers a means of providing light for working in advance headings and stopes of mines or in dark locations on construction and repair jobs. It is said that this unit cannot be harmed by short circuits or overloads if the output terminals are directly shorted. Light is restored the instant the short is removed. The AL-150 Airlite weighs 8¾ lbs.

Lightweight Air Hose

B. F. GOODRICH CO., Akron, Ohio, has developed its new Highflex lightweight air hose for use with small tools that is reported to be stronger, while weighing less than half as much as other hose of comparable strength. The ¼-in. size weighs 8.8 lb. per 100-ft. Working pressures to as high as 250 p.s.i. are possible with this new hose that is oil proof both inside and out. Decreased weight plus added flexibility are claimed to be definite factors in reducing working fatigue.

PERFECT?

Aggregates and Concrete

Corps of Engineers, U. S. War Department, Aims to Get Them

By NATHAN C. ROCKWOOD

CONCRETE IS DEFINED by geologists as a *bioclastic rock*, or more specifically a conglomerate when made of gravel or a breccia when made with crushed stone. There are somewhat similar rock formations in nature. The "bio" means its origin is accounted for by living organisms, mostly animal (which includes the handiwork of mankind), and "clastic" means the rock consists of fragments from preëxisting rocks. These definitions are significant because, from all present indications, there is now in the making a new approach to the study of concrete, based on a more extensive utilization of geological or geochemical research. (Geochemistry is the chemical side of the origin and disintegration of rocks and minerals.)

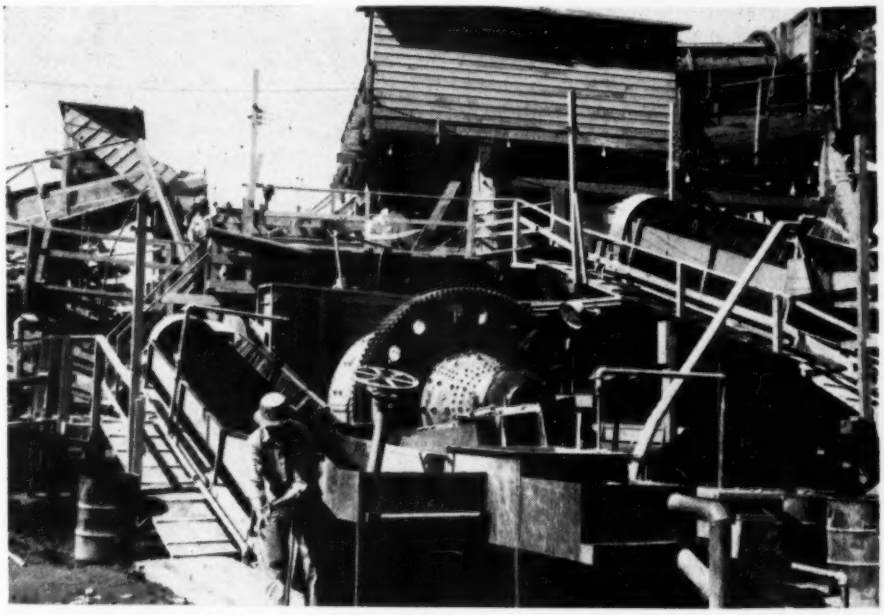
This development is not exactly new, because in the beginning, portland cement chemistry had its first impetus from research in geology and for the past few years developments have been leading up to the application of more geochemistry, first in the attempt to manufacture portland cements according to chemical formulas that are relatively free of alkalies (sodium and potassium salts); and second, to avoid the use in concrete of "chemically reactive" aggregates, which apparently make the concrete unstable in the presence of alkalies in hydrated cements. Those who have kept abreast of recent literature in the Proceedings of American Society for Testing Materials and of the American Concrete Institute are fully aware of the growing emphasis on these factors by the U. S. Bureau of Reclamation, some of the State Highway Departments and most re-

Sized limestone from the Bull Shoals aggregates plant, background, falls to the surge pile, from which it is reclaimed by belt in a conveyor tunnel. Stone is conveyed seven miles to the Bull Shoals Dam construction site on the White River, Ark., in over 21 separate conveyor flights each powered by a separate motor. Total connected power is 200 h.p.

cently by the Corps of Engineers, U. S. War Department.

Execept for highway concrete in the Pacific Coast States and in some sections of the Middle West and Southeastern States, where the use of cherty gravels and limestones is assumed to have caused trouble, commercial producers of aggregates have not been greatly affected until recently. Since the end of the war, however, the Corps of Engineers has undertaken a considerable program of river improvement and flood prevention works, which involves construction of numerous concrete locks and dams. So now, some of these technological developments, which have been largely theory, are now being put into practice. In other words, specifications have been written and are now in force, which producers of aggregates find it very difficult to meet.

Since many of these projected structures are in parts of the country where commercial aggregates are available, and these particular aggregates have been used successfully in concrete for many years, producers find it difficult to understand why they should now be rejected by the Corps of Engineers. It is not the purpose of this article to discuss the merits or otherwise of the new specification requirements, so much as to attempt an explanation of the philosophy which apparently is behind them.



Conical ball mill installed in flow of plant producing manufactured sand for U. S. Engineers Corp. dam at Dorena, Ore. Note 36- and 48-in. sand screws, left and right

Incidentally, this leads to a comparison of bioclastic rocks, both natural and artificial, on the assumption that the end in view for all concrete structures is as strong and durable a conglomerate as nature itself is capable of making.

No attempt is being made to write new specifications for portland cement. However, that is apparently not because present-day portland cements are considered the last word in perfection, but, probably, because the users as yet do not know in what direction to make a move for improving the product, other than to specify the use of air-entraining agents either in the cement or at the concrete mixer.

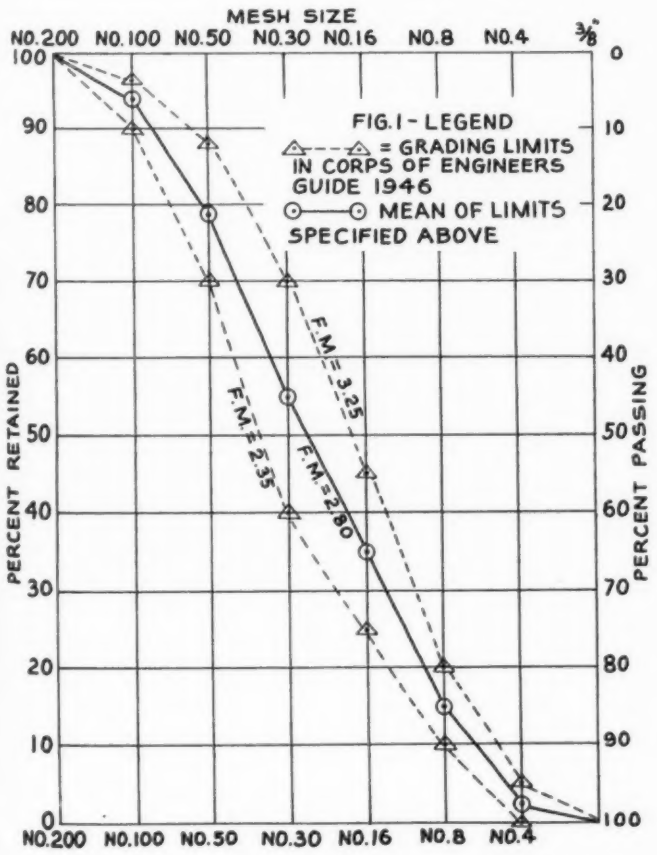


Fig. 1: Grading limits in Corps of Engineers Guide for 1946

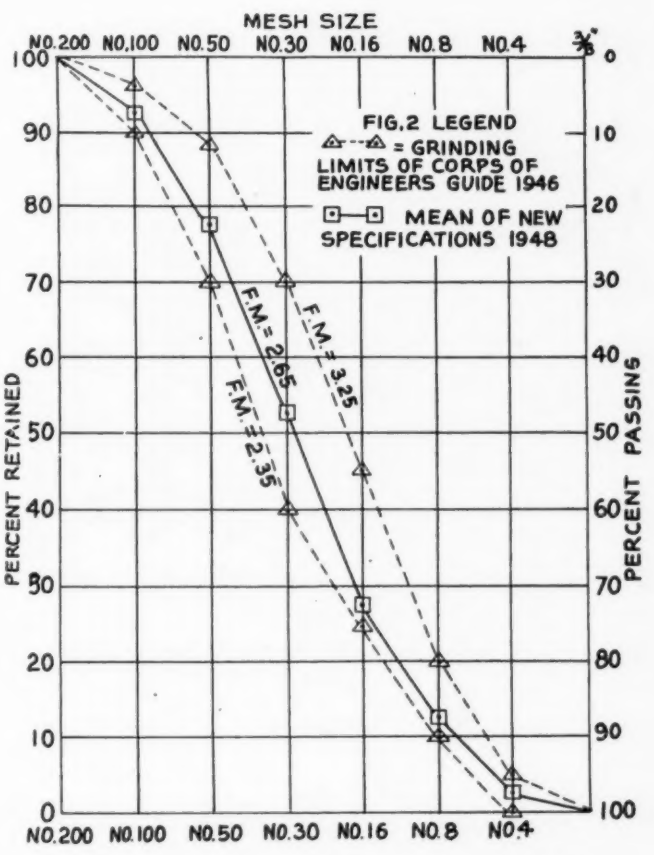


Fig. 2: Grading limits of Corps of Engineers Guide for 1948

Type II or Type IIA portland cements are generally specified for all massive concrete structures. This is the so-called modified, or moderately low-heat, portland cement, without and (A) with an air-entraining agent. The distinguishing feature of Type II cement is the maximum limit of 6 percent on the Al_2O_3 (aluminum oxide) content; ferric oxide, Fe_2O_3, being substituted in manufacture as the clinker fluxing or combining agent.

It is significant, however, that the reason given for the very narrow specification limits on the grading of aggregates is to permit the use of exceedingly lean concrete mixes in the massive concrete ("the absolute minimum of cement"). This may be an indirect acknowledgement that the cement paste itself is regarded with some suspicion, and hence a desire to use as little of it as possible. In any event it is recognized that the more cement used the greater the internal heat of hydration. These structures unlike some of the dams built by the Bureau of Reclamation, will have no expensive facilities for interior cooling.

Although it is proposed to avoid the use of reactive aggregates, both fine and coarse, in such instances that they must be used, because other aggregates are not economically available, the cement is required to be of the "low alkali" type, which means containing not more than 0.6 percent of sodium and potassium oxides taken together, computed as sodium oxide. This has become standard practice for cements furnished the Bureau of Reclamation and for some state highway departments, so it is nothing new to portland cement manufacturers.

The acceptance by the Corps of Engineers of present standard cements may be interpreted in various ways. Probably, with the current short supply they could not get anything different even if they wanted it. They may be satisfied that present cements are as good as any that could be made. They may be engaged in making long-time service tests of the cement itself with more or less ideal aggregates, so that the aggregates themselves may be eliminated in any future discussion of the cause of deterioration, if and when it occurs.

Selection of Fine Aggregates

Three factors in the Corps of Engineers' specifications for fine aggregate make it difficult for many commercial producers to meet requirements, even when their aggregates have passed all the usual tests. These factors are: (1) "thermal compatibility" of minerals of different kinds; (2) the possibility of the aggregate containing a mineral reactive with the alkali in cements; (3) an "ideal" grading in particle size, within limits so narrow as to appear practically impossible of attainment in regular day-to-day operation, if strictly enforced.

The first of these, thermal compatibility, is relatively new to research theory on the cause of concrete disintegration, but it is a well recognized, long-time factor in geochemistry as a cause of the disintegration of natural rocks. This approach is, as we noted at the beginning of this article, evidence of the growing use of geology and of geologists in attempting to trace the causes of concrete failures. There are few if any natural rocks that disintegrate as rapidly as some recent concretes, but it is undeniable that differences in the thermal coefficients of expansion between the various minerals of which many rocks are composed are real factors in their ultimate disintegration. More or less related to expansion is thermal conductivity, which is the rate at which heat or cold is transmitted through a mineral.*

The measure of thermal expansion of a mineral is its increase per unit length for each degree increase in temperature. Naturally, this is a very small amount as in units to 10^{-6}, or $\frac{1}{1{,}000{,}000\text{th.}}$ To avoid such unwieldy fractions the "coefficients of

*See "A Study of the Influence of Thermal Properties on the Durability of Concrete." by Albert Weiner, Journal of the American Concrete Institute, May, 1947.

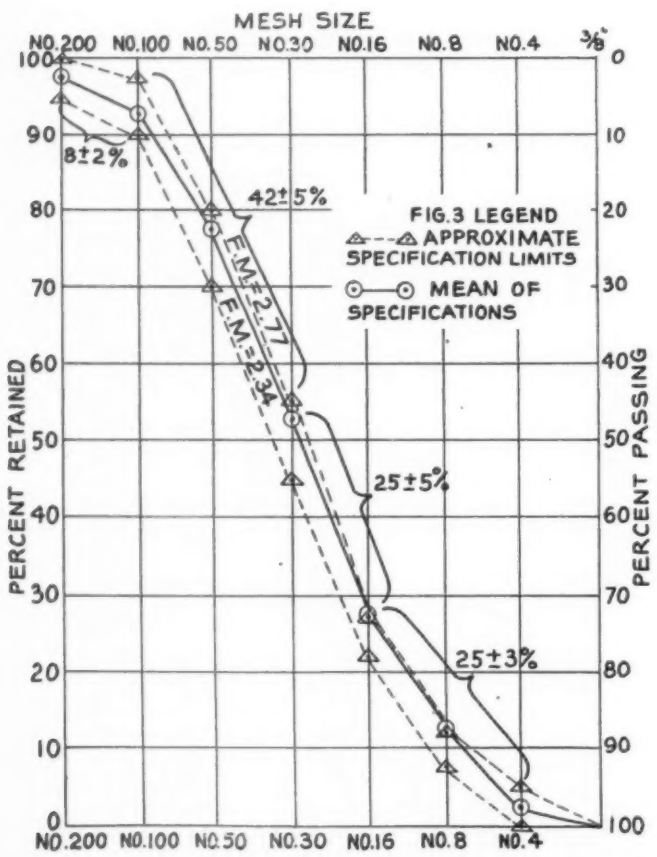


Fig. 3: Approximate specification limits

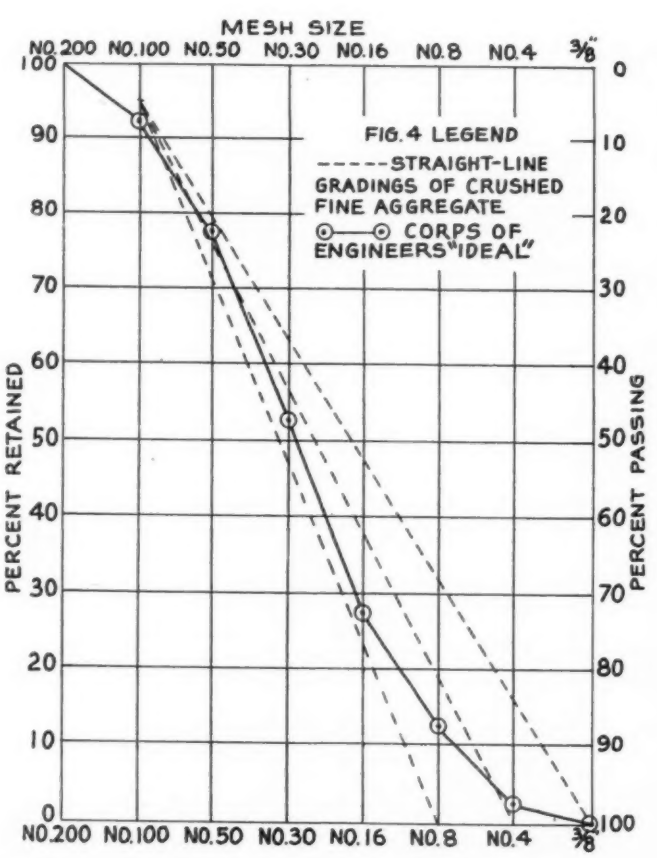


Fig. 4: Straight-line grading of crushed fine aggregate

expansions" are the units $10^{-6} \times 10^{6}$, so that an exansion of $\frac{5}{1{,}000{,}000\text{ths}}$ of an inch, per inch of length, would be a coefficient of 5. Thus, if we wish to use a coarse aggregate such as limestone, which has a relatively low coefficient, say 2, and a quartz sand, which may have a coefficient of say 6, we are, according to the Corps of Engineers' theory, combining aggregates which are not thermally "compatible." The coefficient of expansion of the solidified neat cement paste may or may not be higher than that of silica, but this does not appear to be considered as important a factor. The coefficient of the ordinary sand mortar matrix is apparently in between that of limestone and silica.

On the basis of the preceding assumption a piece of limestone aggregate 6-in. long would expand $0.000002 \times 6 = 0.000012$-in. for each degree F. rise in temperature or $0.000012 \times 180 = 0.00216$-in. in rising from 32 to 212 deg. F., and a piece of silica 6-in. long, or a series of silica grains, end to end, 6-in. long, would expand three times as much or 0.00648-in. It is difficult to visualize differences in expansion and contraction so minute as this causing destruction of concrete, which, according to accepted theory has a certain amount of "flowability," long after it has hardened. It is also presumed to have some elasticity. The analogy with the disintegration of coarsely crystalline rock like granite does not seem very exact, because in most of the natural rocks, where the crystals are of different mineral compositions with different coefficients of expansion, they are much more tightly packed together than the fragments of various minerals in a concrete, even the best of which has far more pore space than most rocks.

The test upon which the Corps of Engineers bases the theory of incompatibility of aggregates of different mineral composition in concrete is what is known as a "shock test"—rapid alterations of freezing and thawing. The reliability of such a test as a thermal compatibility test is questioned by most of those familiar with it, outside the Corps of Engineers. That it is a severe, accelerated, but unnatural test of the durability of a concrete may be granted, but whether the relative coefficients of expansion are important factors is open to question. For the time being anyhow, the conclusions drawn from the theory of thermal compatibility may prevent a natural silica sand from being used as fine aggregate with high-calcium limestone coarse aggregates, or in other combinations where the Corps of Engineers considers the thermal coefficients of expansion too far apart.

Reactive Constituents

Hitherto, the discussion about reactive aggregates has been concerned chiefly with coarse aggregates, although that certain natural sands in California could be responsible for excessive expansion of test specimens was proved by the earliest investigator, Thomas E. Stanton, about 1940.* Since then there have been many laboratory experiments to attempt to determine the cause of destructive expansion in concrete structures, which may not take place until several years after they have been completed. While there is still considerable mystery about the exact nature of the chemical reactions which take place within the concrete, it is now generally accepted that these reactions are fundamentally between an active form of silica in the aggregate and the sodium and/or potassium hydroxides set free in the hydration of the cement, resulting in the formation of soluble alkali silicates.

Soluble sodium and/or potassium silicates have the property of acquiring more and more water (in other words they are strongly diliquescent), and in some manner (osmotic pressure?) the pressure of this liquid in the interior of the concrete disrupts it. It is a fact that particles of aggre-

*"Expansion of Concrete Through Reaction Between Cement and Aggregate," by Thomas E. Stanton, **Transactions**, Am. Soc. of Civil Engineers, Vol. 107 (1942).

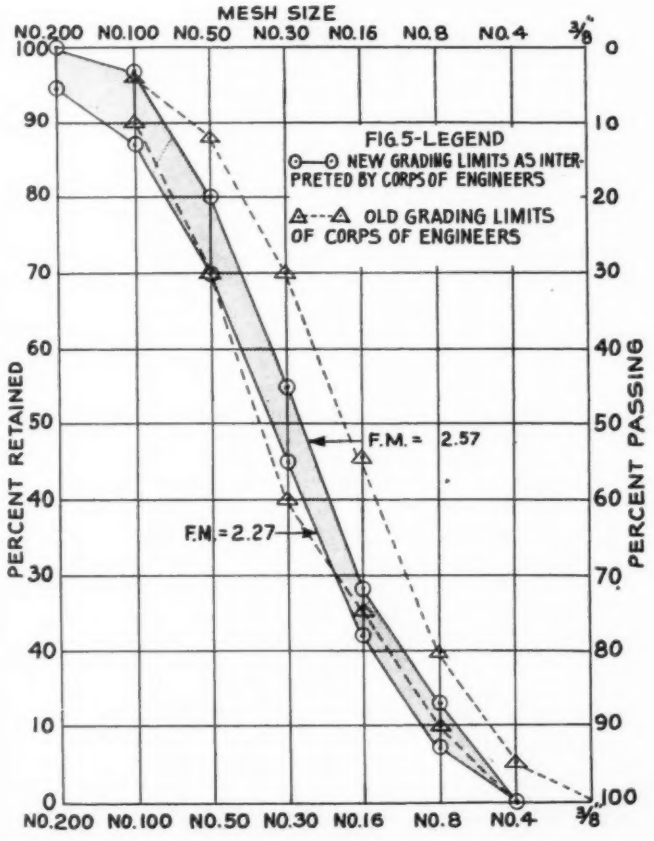


Fig. 5: New grading limits as interpreted by Corps of Engineers

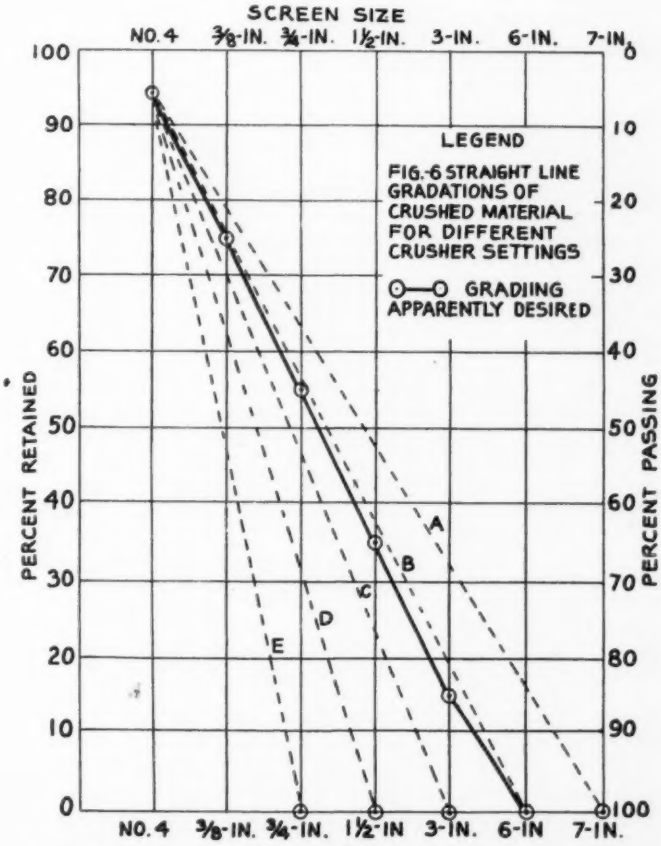


Fig. 6: Straight-line gradations of material for different crusher settings

gate in which an active form of silica is an appreciable constituent, are the ones which show accumulations of silicate solutions in the concrete next to them. There seems to be some evidence that the soluble alkali hydroxides are drawn to such particles from the surrounding mortar, or cement paste, in the process of hydrating and hardening. That the reactive aggregates themselves may contain alkali silicates which are also soluble does not appear to have received much study, for engineers are permitting such aggregates to be used with "low alkali" cements.

From various laboratory experiments it would appear that "reactive silica" is widespread in nature's rocks, since silica is by far the commonest of all minerals in the Earth's crust. It also is the most permanent of all common minerals, since it survives as gravel and sand long after other rock minerals have been reduced by erosion and weathering to silt and clay. The most reactive form of silica found in rocks is what is known as opal or opaline silica. It is silica which has been dissolved in water, or water containing dilute alkalies or organic acids, and redeposited with some of its combined water; or it is "hydrated silica." It is a common form of binder or cement in many kinds of rocks—and a very excellent one. However, it is the kind of silica most readily dissolved by the alkali hydroxides, and therefore, according to the theory of expansion caused by reactive aggregates in combination with high alkali cements, an aggregate containing opaline silica is "poison" to concrete construction.

Other forms of reactive silica are known as chalcedony, chert and flint. Geologists differ on exact definitions for these forms of silica, but all of them have in common a structure of such very fine grains that they are frequently described as amorphous or fibrous (that is, not granular or crystalline at all), or cryptocrystalline, which means crystals too small to be seen through a microscope. Like opal, it is presumable silica which has been in solution or in colloidal form and has been redeposited, and it may be cemented into a solid mass with some small amount of opal. In any event, whether because of its extremely fine-grained constitution and minute pore spaces, or because of its small content of opal, so-called chalcedony, chert and flint or rocks containing them are among the aggregates listed as undesirable for use with high alkali cements.

Quartz is the commonest form in which silica is found in nature; and it is the most permanent component of rocks, since the quartz grains of such rocks as granite survive all the other kinds of mineral grains of which the rock is composed. Hence, quartz is resistant to alkali reaction unless it is very finely pulverized. The rock quartzite, which is one of the strongest, toughest and most durable rocks in all nature, is a metamorphosed sandstone, consisting of quartz grains cemented with a silica binder, presumably deposited from solution, possibly with the aid of heat and pressure. Similarly many of the natural clastic rocks are made of mineral particles cemented together with colloidal silica or complicated silicates comprised of sodium, potassium, calcium, magnesium, iron aluminum and silicon oxides or hydroxides. These are stable silicates formed by inter-reaction with the various mineral elements, all of which are present in some degree in hydrated portland cements. What we don't know is how the stable balance is achieved.

However, there does not exist in all nature any silicate binders which are as basic or alkaline as those found in portland cement pastes. Such silicates are known to be unstable, and reactive in the presence of water and of various dissolved minerals and gasses in water. Therefore, the search for a "permanent" concrete evidently lies in the direction of avoiding unstable alkali silicates or of developing a silicate combination which will remain relatively stable in the hardened concrete. The important point to remember is that concrete once thoroughly dried out or one that is relatively impervious to water seldom gives any trouble. It is concrete in pavements, dams and retaining walls, subject to infiltration of rain and ground water that disintegrates the fastest.

Grading of Aggregates

That proper size gradation of both fine and coarse aggregates is an important factor in producing a dense or "impermeable" concrete, of course, is one of the oldest principles in concrete construction. It is not surprising, therefore, that more emphasis is again being placed on aggregate size gradation as a means to that end. The new specifications of the Corps of Engineers represents the ideal or ultimate in such gradation. Experience has shown that it is next to impossible to meet such specifications with anything but a crushed fine aggregate, which theoretically at least contains about the right amount of all the various size fractions. Natural sands can be made to meet these specifications only by the most laborious methods of extraction and blending or recombining processes.

The former specifications of the Corps of Engineers for aggregate are as follows:

PASSING SIEVE NO. 4 TO NO. 100

Passing No. 4	95–100 percent
Passing No. 8	80– 90 percent
Passing No. 16	55– 75 percent
Passing No. 30	30– 60 percent
Passing No. 50	12– 30 percent
Passing No. 100	3.5–10 percent

These are the limits plotted on the chart Fig. 1. They are practically the same as those given in the "Concrete Manual" of the Bureau of Reclamation, which we have illustrated a number of times previously as "the usual Federal specification." The Bureau of Reclamation allowed a spread of 60 to 80 percent passing the No. 16 (instead of 55-75) and 2 to 8 percent passing the No. 100. Otherwise the limits are the same and it is feasible, as demonstrated in numerous operations, to meet them with any sand so graded as to fall within these outside limits.

The proposed new specification of the Corps of Engineers is as follows:

PERCENTS RETAINED BETWEEN SIEVES

Sieve Sizes	Desired but not Mandatory	Mandatory
No. 4 to No. 8	10	
No. 8 to No. 16	15	25 ±3
No. 16 to No. 30	25	25 ±5
No. 30 to No. 50	25	42 ±5
No. 50 to No. 100	17	
No. 100 to No. 200	5	8 ±2
Minus No. 200	3	

This appears to be a complicated specification to illustrate by a chart because of the limitations between the bracketed sizes. An excess, for example, of 25 percent in the No. 30 to No. 50 size would reduce the allowable No. 50 to No. 100 size, or *vice versa*, since the sum or the two must not exceed the limits of 38 and 47 percent retained on the No. 100 and passing the No. 30.

Usual Specifications

We do not find, however, in any of the job specifications we have received to date, that such a specification is being required. The usual one found is as follows:

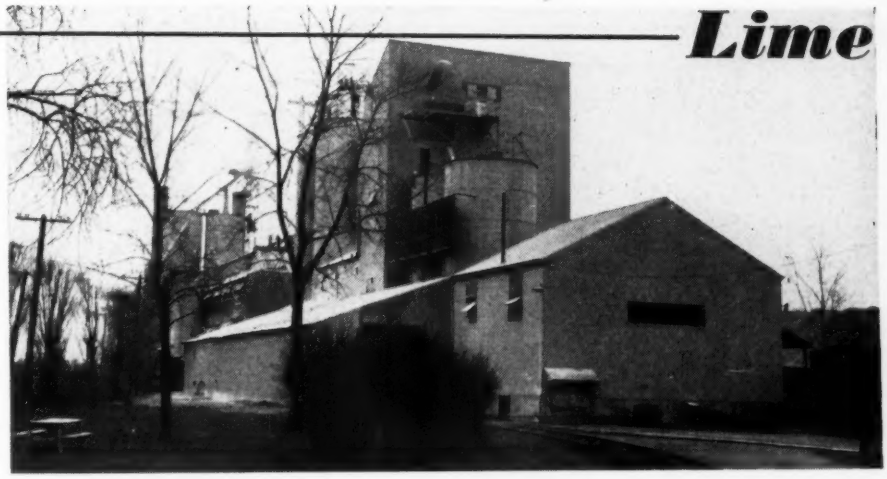
Sieve Nos. Passing	Retained	Percent by Weight Minimum	Maximum
	No. 4	0	5
No. 4	No. 8	5	15
No. 8	No. 16	10	20
No. 16	No. 30	20	30
No. 30	No. 50	20	30
No. 50	No. 100	10	20
No. 100		6	10

The requirements for minus No. 100 vary a little in the different job specifications. However, if one adds up the cumulative percents retained he will not get a fineness modulus figure for either column because the column of Minima adds up to only 71 percent and the Maxima to 130 percent. In other words, neither a sand meeting the apparent minimum or the apparent maximum limit would come anywhere near meeting the size grading requirement.

However, if we take the mean of these two columns we get:

(Continued on page 156)

National Lime Association, Operating Division, holds successful meeting—inspects Marblehead Lime Co. plant



Overall view of So. Chicago plant of Marblehead Lime Co. Note absence of dust

SAFETY AND OPERATING IDEAS

SOME 70 EXECUTIVES and superintendents charged with the responsibility for plant operation attended the annual meeting of the Operating Division, National Lime Association, at the Palmer House, Chicago, November 4-6. The program was excellently arranged and considered four important topics, each to a session, so that the subjects could be adequately covered and given sufficient time for maximum audience participation. It has been our experience as observers at conventions that far too many subjects are often scheduled for discussional types of meetings with the result that each is considered on the surface and discussion is stifled. The officers of the Association, Wallace E. Wing, president of Marblehead Lime Co., Chicago, and others who participated in planning the program should take a well-deserved bow.

The safe handling of materials, ways to get the most out of coal, a questionnaire session for consideration of plant problems, and packaging were the principal topics for the four business sessions. One morning was devoted to an inspection trip to the South Chicago plant of Marblehead Lime Co. followed by a group luncheon at Phil Smidt's famous restaurant as guests of the company. National Lime Association was host at a group luncheon on the opening day.

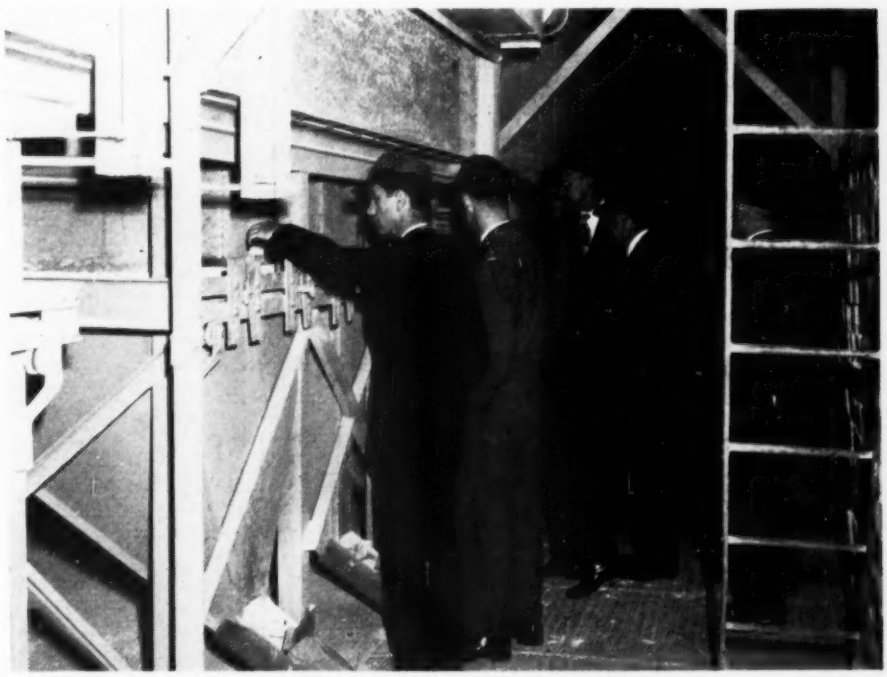
Wallace E. Wing opened the meetings by urging maximum participation from the floor in discussion to follow presentation of each subject under consideration. H. M. Beattey, chairman for the opening session, then introduced Lea P. Warner, Jr., engineer, Warner Co., Philadelphia, who discussed safe practices in their relation to handling materials.

Material Handling—Safety

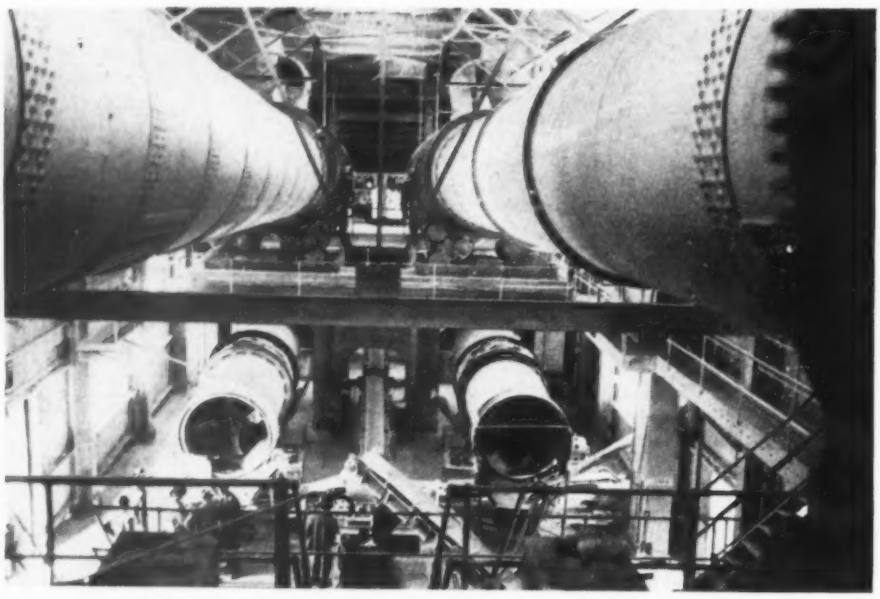
Lea Warner, said Mr. Beattey, is a graduate in mechanical engineering from Cornell University, and is a member of the executive committee for the Cement and Quarry Section, National Safety Council. His experience in safety work has been extensive with his company and is supplemented by valuable experience in safety and personnel work with the Navy during the war in his service as safety officer at aircraft factories, naval depots and bases.

"How Do You Handle Materials" was the title of his paper and its selection was an appropriate one for, while his subject was safety in handling materials, he particularly stressed throughout that safety and actual materials operations are not separate but related activities. He kept hammering away at the correct way to handle materials, as being the only safe way, in order to be efficient and economical.

In pointing to the great need for correct handling methods, Mr. Warner cited the article "Waste-Chasing Transportation" by I. F. LeGore in the August, 1948, issue of ROCK PRODUCTS, pp. 158-159, which mentioned that some people believe that 90 percent of all industrial activity is material handling. It further pointed out that handling expenses account for 33 percent of the labor payroll of manufacturers and that 80 percent of workers regularly handle materials.



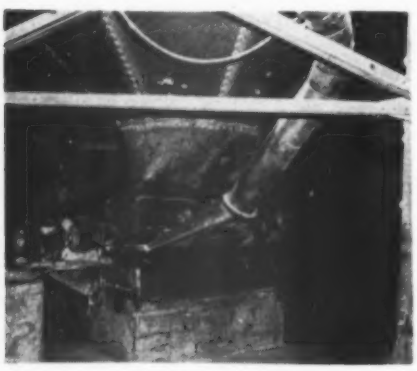
Visitors to the Chicago plant of Marblehead Lime Co. during field trip of the Operating Division, National Lime Association, proving to themselves that lime coming from the kiln is cool enough to literally "handle"



Two rotary kilns, top, discharge at far end to two coolers for return flow, bottom. Material from coolers falls to common collector belt

Much of Mr. Warner's presentation dealt with improved methods which will eliminate hazards that exist with inefficient, hand methods of handling materials. He mentioned how much valuable production time is lost every time an accident occurs and the loss in experienced help when by necessity a trained man must then be replaced. He suggested that a thorough study be made of all accidents including those incidents which do not involve injury but which, if not recognized, will eventually lead to injuries. In making thorough studies such as he recommended, he said that sufficient facts can sometimes be presented to top management to warrant the heavy expenditure of mechanizing a quarry. Increased production that can result is an aid, of course, to making such a decision. He mentioned that, in mechanizing his company's quarry the hazards have been eliminated and safety has been made an integral part of production. The costly substitution of suitable mechanical means of handling materials for manual procedures might be considered due to the chances of eliminating hidden costs and human wastage.

An accident, he pointed out, is evidence that something has gone wrong and often from causes which spread their effect over a far greater field than the accident itself, meaning that methods of handling are inefficient and therefore costly. To emphasize the cost of injuries, he quoted National Safety Council figures that there were 17,000 industrial fatalities during 1947, 90,000 permanent disabilities, 2,050,000 temporary disabilities and that the total economic loss exceeded seven billion dollars. About 25 percent of all permanent injuries and fatalities occur in handling materials.



Dust collector installation above bag packer

He considers the 54.23 accident frequency rate for the lime industry in 1947, and 53.12 average for the 1938-1947 period, as very poor and said that any accident frequency rate in excess of 10 means that a job in accident prevention must be done.

In his discussion of training, he pointed out that today's workers have much better education than hitherto, are therefore critical of their superiors and therefore one of the most important jobs facing top management is the proper training and support of its supervisory personnel.

Mr. Warner urged that consideration be given to membership in the Cement and Quarry Section of the National Safety Council and then introduced Mr. Greeve of the National Safety Council who presented a film designed to point out hazards in jackhammer operation and safe practices. Mr. Greeve was narrator for the film which is the first of a series being made for the rock products industries. It was filmed at the Oglesby quarry of Marquette Cement Manufacturing Co. and was a most excellent presentation. It illustrated proper dress, the need of training, the use of shatterproof glasses, tool inspection, inspection methods for loose rock, scaling of rock, how rock to be drilled should be set out from the quarry face, the use of slack in air lines to prevent tripping, inspection for misfired holes, etc. The film with script is available and actually costs only $10.

Mr. Warner then concluded his talk with a presentation of a great number of photographs showing common unsafe practices which need elimination. They represented actual instances from his own observations.

At conclusion of this session, William T. Harvey, chemical engineer, N.L.A., presented the 1000-Day Club certificate to John A. Sechrist, superintendent of the Thomasville plant, The J. E. Baker Co., of York, Penn. That plant had worked 1965 days, or 425,000 man-hours, since May 20, 1943, without lost-time accident as of date of presentation. The J. E. Baker Co. is the eighth company thus far to merit a certificate and has received safety certificates ten times since its enrollment in the National Lime Association Annual Safety Competition in 1935.

Asked to comment briefly on his company's safety policy Mr. Sechrist credited top management because of its interest and emphasis on safe operation. Monthly informal safety meetings are held, plants are regularly inspected and safety is considered more important than production.

Thursday afternoon the session started with Robert S. Boynton, manager of the National Lime Association, taking the lead in an effort to draw our ideas for future meetings. One speaker mentioned that production control data, rather than cost figures might make an interesting subject for discussion.

The idea was advanced to allow plant superintendents to tell the owners some of their problems and desires instead of having what the speaker called "Brass hat" papers. This brought up the question as to where superintendents could be secured who would speak out and make the meeting a success, and it was thought that if one superintendent could be selected as a "lead" speaker, the rest would participate. It was also suggested that they get some competent authority outside the industry to discuss "human engineering" and general public relations problems. Training of men was another subject suggested. Irving Warner said that a lot of the value he has had from these meetings come from the "man to man" discussions, where he could ask a question or have to answer one. Round-table discussions were preferred.

Coal for Burning Lime

The balance of the afternoon was devoted to a paper by Dr. Huston St. Clair, president, Jewell Ridge Coal Corp., Tazewell, Va. He spoke on "The Selection and Use of Coal in the

Production of Lime." Mr. St. Clair introduced a new word to the lime industry when describing the characteristics of coal and that word was "reactivity." He said, "reactivity is the term used to denote the ability of coal to unite with oxygen. A coal with a high laboratory B.t.u. value but low in reactivity may, in a pulverized fuel installation, be 10 to 50 percent less efficient than another coal of the same laboratory B.t.u. value but with high reactivity. This quality is more important in pulverized fuel installations than in any other type of firing. In hand-fired installations the difference between high and low reactivity coals is not very considerable but in stokers the difference may be from 5 to 15 percent."

This portion of the paper brought forth considerable discussion and one question that seemed uppermost in most minds was "How to determine reactivity in the laboratory." The speaker said that reactivity was closely related to the flash point or ignition temperature of a fuel but he thought the Association should get information on tests for reactivity from the Bituminous Coal Institute at Pittsburgh, Penn. He said that the addition of oil to coal would increase its reactivity. He knew of no way to retard it. He also brought out that from a single seam in a given mine, reactivity would probably not vary a great deal but over a wide area (thinking in terms of miles) the same vein of coal might have different reactivity quotients.

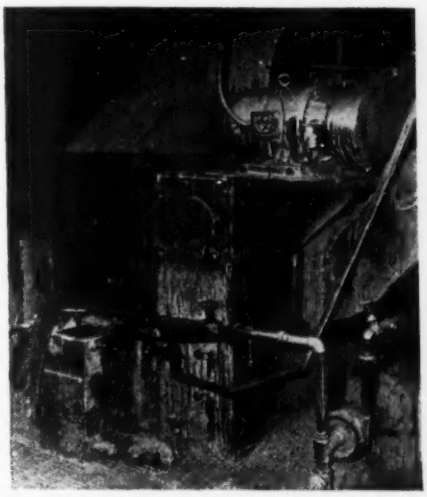
Victor J. Azbe pointed out that charcoal had the highest reactivity of the group and that for most lime burning operations, reactivity was not too important, in his opinion, except in producer gas installations. Irving Warner, vice-president, Warner Co., brought up the idea that possibly a coal with low reactivity would be better because some limes absorb heat slowly. However, he said that a low reactivity in coal might result in more unburned material going through the kiln.

It was also brought out in the discussion on this interesting phase of Mr. St. Clair's paper that a coal with a high volatile content and a coal with a low volatile content may have widely different reactivities. The speaker was asked if a low reactive coal would make lime dirtier and the answer was "Yes." He also indicated that the analysis of the ash was no indication of a coal's reactivity.

On the subject of stockpiling and spontaneous combustion, the speaker said it had been observed that high sulphur coals have a greater tendency to ignite spontaneously than similar low sulphur coals. High sulphur coals also increased the formation of sulphurous and sulphuric acid on oxidation in the pile and this could cause stream pollution and damage to metal pipes. Good drainage of the pile was the solution to this condition, he felt. He pointed out the necessity for low sulphur in lime used by the steel industry.

He said there were two forms of sulphur in coal; volatile and fixed. The volatile sulphur in the kiln either goes out the stack or combines chemically with the lime. The fixed sulphur is apt to stay in the ash. He pointed out that the concentrations of sulphur picked up by the lime are at the surface of the particles when such sulphur came from the volatile component. He also mentioned that fixed sulphur could be in the lime as a part of the ash that settled out in the kiln. He said that some of the sulphur in the original limestone could be driven off in the furnaces. He showed drawings that were supplied by the Warner Co. which showed a stone with a sulphur content of 0.4 percent. In one case the coal sulphur was 1.22 percent and in a second it was 0.86 percent. In the first case the periphery sulphur content in the lime was more than twice that of the original stone, but where the sulphur in the coal was low, the increase of sulphur in the lime was hardly apparent. He said that coal users should weigh the dependability of a coal mine to make regular and consistent shipments as it minimized stockpiling, reduced weathering problems and inventories. He felt that where the cost of coal was a considerable item in the manufacture of a product that users of coal in these industries should spend more time and thought on the selection of a coal that would best suit their needs.

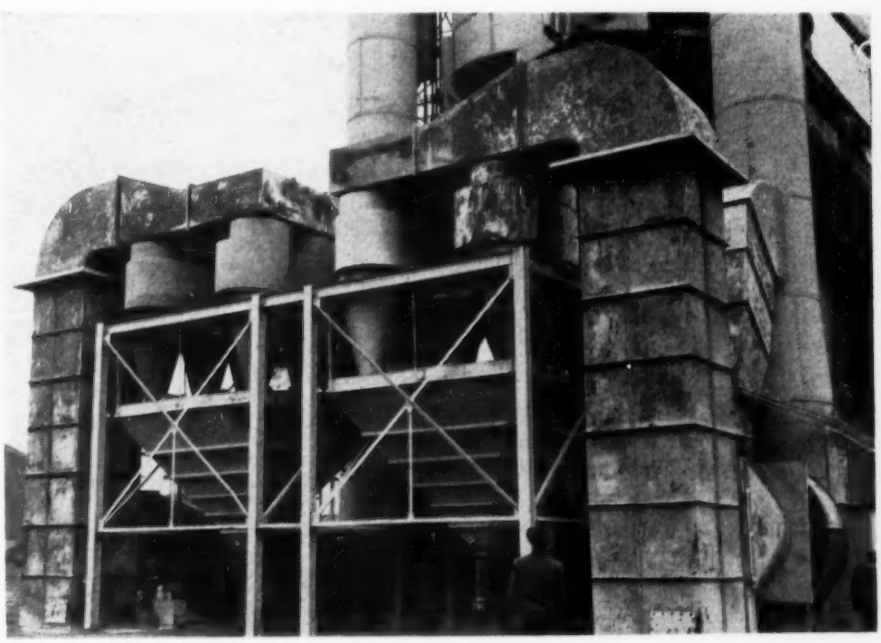
He said that the ideal coal for a mixed-feed kiln where alternate layers of fuel are used was a coal uniform in size, with hard surface structure,



Water used in this dust collector, mounted over hydrator, returns to the hydrator when dust-saturated

low coking and caking properties, and with low volatile content with a minimum of sooty or tar-making hydrocarbons, but that it might be difficult to get all these characteristics in one coal. He mentioned the advantages of stokers and gas producers as against hand-firing.

In discussing heat transfer by radiation, convection and conduction the speaker said, "It is very doubtful that luminosity per se has any appreciable effect." In the discussion that followed on this phase of the paper many on the floor held to the opposite theory and spoke so convincingly, based on their experiences, that the speaker, in a private conversation, said he was converted. The speaker said that for rotary kiln operation "water shedding or absorbing" properties of the coal, the grindability and the reactivity were especially important in considering coal selection. In speak-



These dust collectors on the rotary kilns at the So. Chicago plant aid in keeping plant dustless

ing of grindability for industry in general he said, ". . . the pulverizers' total capacity for an average plant requires coal with a grindability index of 105. Any plant should have, as a minimum requirement, sufficient pulverizer capacity for a coal with a grindability index of 50." Reactivity of coal in rotary kiln operation was again stressed. He mentioned a textile plant where a high-grade, low volatile coal with a high grindability was first used with poor results. Another coal of almost identical analysis was tried under the same conditions and there was an increase of 12 percent in efficiency. The only difference was in the reactivity of the two coals; the latter one had the higher reactivity.

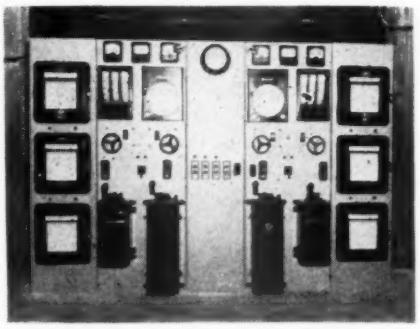
Mr. St. Clair also discussed ring formation in rotary kilns and suggested that larger particles of ash could be trapped by burning a part in a combustion chamber. Then such fine ash as was left would probably go out the stack.

Stockpiling Coal

The speaker was asked if stockpiling would have any effect on reactivity and he answered "No," and also pointed out that the B.t.u. value in a high volatile coal should not change in stockpiling over a six months' period. On the subject of luminosity, one operator mentioned that he added 1 percent salt (sodium chloride) to the coal and that almost at once the temperature of the lime coming out of the kiln increased greatly but that it soon cooled down and returned to normal, even with continuous use of the salt-treated coal. No theories as to why this was true were forthcoming. On the subject of sulphur in lime, Mr. Azbe spoke of feeding calcium oxide to the producer coal and allowing the sulphur from the coal be absorbed there.

Irving Warner pointed out that the men who run the kilns do not like stockpiled coal and asked for reasons. One thought was that possibly lime dust on the coal would be a factor and another was that possibly segregation of the fines from the coarse particles in the pile might influence combustion. On the subject as to the best method to stockpile coal, it was brought out that the best way was to pack it down on the theory that it would keep out air and possibly more water. Mr. St. Clair said that general practice in a stockpile is "to have lots of air or none," so as to keep down spontaneous combustion. Asked if oil from tractors would increase spontaneous combustion in the coal, the speaker pointed out that some coal companies add oil to coal to reduce the dust problem, and even among those coal producers who did this, the question was debated. Mr. Warner asked if a loss of 1 to 2 percent of the volatile matter in stockpiled coal would account for its "lazy" burning and the speaker had no information on this point. One operator mentioned the use of calcium chloride in his plant, stating that he added one gallon per ton of coal and that this reduced freezing. No corrosion took place in the coal mills, and there were not ill flame effects. The speaker pointed out that $CaCl_2$ was used on household coal to reduce dust and that this chemical reduced the fusion point of the ash.

Friday morning there was an inspection trip to the South Chicago plant of the Marblehead Lime Co. in chartered busses. Prior to their departure each guest was given a printed pamphlet by the Marblehead Lime Co. This pamphlet gave the guests a considerable mass of technical background relating to the operation as well as a general map of the plant's layout. Once the guests arrived at the plant, they were more or less on their own and Wallace E. Wing, president of the company, had men in white scattered about the plant to answer any visitor's questions. The plant inspection program was well-planned and executed.



Switchboard for rotary kiln control located near hot end of kiln

Inasmuch as it is the intent of the Association to hold future meetings near plants that can be inspected, we are including considerable data in this bulletin as a guide for other plant operators in planning.

The map of the plant had the important features numbered and the text of the bulletin described briefly each numbered section. For instance, on map No. 1 relating to the coal storage pile, it was pointed out that the coal came from southern Illinois, Majestic mine. The coal is 1-in. to No. 28 washed coal and has the following analysis:

Typical Analysis

Moisture	8.59 percent
Ash	8.05 percent
Volatile	32.60 percent
Fixed Carbon	50.76 percent
B.t.u. per lb.	11900
Sulphur	1.37 percent

Then, in numerical order, as appear below were the other listed high points of the plant:

2. Warehouse.
3. Inland Limestone stockpile size ¾- x 1½-in. from Manistique, Mich., by self-unloader boat.
4. Michigan limestone stockpile Size ¾- x 1½-in. from Calcite, Mich., by self-unloader boat. A portion treated with calcium chloride to prevent freezing.
5. Induced draft fans Present capacity 77,000 c.f.m. at 650 deg. F. and 5-in. S.P., 635 r.p.m., 92.5 b.h.p. Maximum capacity 84,000 c.f.m. at 650 deg. F. and 6-in. S.P., 700 r.p.m., 123 b.h.p. Driving motors 150 hp. Electrically-operated louvre dampers controlled from firing floor.
6. Buell dust collectors

Visitors inspecting area immediately below hydrators

Six No. 12½ A2 units, 2.7-in. draft loss at 77,000 c.f.m. and 650 deg. F. 99.5 percent efficient on dust 43 microns and larger.

7. Flue chambers
   Entering kiln gases approximately 1600 deg. F. cooled by water sprays to 700 deg. F.
8. Kiln stone storage tanks
   Capacity 450 tons each.
9. Skip hoist
   Link-Belt, automatic, electric drive, 60 c.f. bucket.
10. Feed floor—second story level. Kiln pan feeders synchronized with kiln drive. Ellernan stone feed conveyor.
11. Ellernan kilns
    Size No. 2 calciners, minus 1½-in. stone, gas-fired, 6,500,000 B.t.u. per ton, output 10-12 tons each per day. Temperatures: oven 2350 deg. F., exhaust 550 deg. F., discharged lime 200 deg. F.
12. Rotary kilns
    Vulcan, 9- x 175-ft., 185 tons per day, 2.53 fuel ratio, speed 63-94 seconds per revolution.
13. Firing floor—second story level
    All instruments and control stations for rotary kilns, coal mills and induced draft fans.
14. Rotary coolers
    Vulcan, 6- x 60-ft., 3 r.p.m.
15. Coal pulverizers
    Raymond No. 452 bowl mills. 100-hp. motor drive. 90-93 percent minus 200-mesh fineness maintained.
16. Bulk pebble loading track
17. Screen house
    Robins, style M, Vibrex, 4- x 12-ft., single-deck, 3-section screen, producing ¾- to 1½-in., 5/16-in. to ¾-in. pebble lime. Minus 5/16-in. sent to hydrator.
18. Screened bulk pebble storage tanks
    Capacity 500 tons.
19. Pebble lime bagging machine
    St. Regis, Type 301-FB, packaging rate 3-100 lb. bags per min. Uses 4-in. tuck-in sleeve valve bag.
20. Pulverizer
    Raymond, 4 roller. single whizzer separator, high side mill. 3½ t.p.h. ground quicklime.
21. Pulverized quicklime storage tank
    Tank
    Bates 2-tube packer.
22. Lime hydrating equipment
    Kritzer 6-tube hydrator, premixing chamber, water controlled by weir box. Raymond 5-ft. 6-in. double-whizzer separator with No. 1 beater mill. Fineness plus 99 percent minus 200-mesh.
23. Rotoclone separator
    American Air Filter Co. Type N. Wash water used for hydrator. Continuous circulation to weir box.
24. Hydrated lime storage tanks
    Bates 4-tube packers.

Three features in the plant particularly seemed to interest the visitors. They were the Buell dust-collecting installation on the rotary kilns, the two Ellernan kilns, and the Rotoclone dust collectors on the hydrators. Incidentally, the Ellernan kilns at this plant are the most easterly installation of that equipment in the United States.

After the morning plant inspection, the visitors were luncheon guests of the Marblehead Lime Co. at a Hammond, Ind., restaurant.

Kiln Burners

Robert A. Temple, vice-president, Marblehead Lime Co., Chicago, led a discussion on the advantages and disadvantages of natural gas as fuel for rotary kilns. Discussion brought out that it is difficult to get full fuel efficiency from the use of natural gas, chiefly because of lack of luminosity in the flame. Since a rotary lime kiln depends largely on heat transfer by radiation, this lack of luminosity is a serious defect. To correct it some operators have tried using some pulverized coal with natural gas. According to Victor J. Azbe, consulting engineer, St. Louis, Mo., it is possible to burn natural gas to get some luminosity, if the burner and primary combustion air are so adjusted that "cracking" of the gas occurs and carbon particles result.

The design of the gas burner is a very important factor. To get the most efficient heat under a boiler the gas and combustion air should be thoroughly mixed as they enter the combustion chamber. However, in the case of combustion in a rotary kiln, thorough mixing of gas and air before introduction into the kiln results in complete combustion in a short, intense flame, which is not at all what is desired. Such a flame is hard on the kiln lining as well as inefficient for radiation heat transfer. Hence the design and location of the burner is very important. Apparently the most satisfactory results are obtained when the gas and primary air are admitted separately, and in some instances around the periphery of the gas inlet, or that of the kiln hood, through small jets. This provides slow mixture of the combustion air with the gas, and prevents stratification of the flame and hot gases in the kiln.

It was acknowledged by all that natural gas is the ideal fuel for shaft kilns. The interesting point to an observer is that natural gas is becoming much more widely available, and with the price of coal constantly on the increase, and quality on the decrease, lime producers appear willing to pay a much higher B.t.u. cost for natural gas than for coal. The chief handicap to the use of natural gas for burning lime, as well as for other industrial uses, is that usually it cannot be had in the quantities desired the year round. In winter time home-heating demands are given priority.

Some manufacturers have tried to substitute pulverized coal for gas in shaft kilns designed to burn gas, but apparently without complete success. The coal ash is left in the lime, often as a glaze or surface coating, which affects its quality for most purposes. In the case of rotary kiln installations it is relatively simple to switch from gas to pulverized coal, or vice versa, or even to use both simultaneously.

Rotary Kiln Rings

The cause of and the removal of rings in rotary kilns is a perennial subject when operators get together. One of the wonders of the lime industry is the New Canaan, Conn., plant of the New England Lime Co., where the rotary kilns appear to be mostly free of ring troubles. Operators of rotary lime kilns from all parts, who like New England Lime Co. burn pulverized coal, have visited New Canaan to see and to try and figure out the reasons. It seems the burner pipe at the New Canaan plant is directed downward toward the ap-

(Continued on page 160)

One of the two fine grinding mills inspected by the group at Marblehead Lime Co. plant

Manufactured Sand For Large Concrete Structures

Suitable types of quarry material and plant detail for production of stone sand to meet Government specifications

By GEORGE C. HAWKINS*

THROUGH EXTENSIVE tests and experiments in their laboratories, the U. S. Engineers have come to the conclusion that for large concrete structures manufactured sand, when used with coarse aggregate produced from limestone, produces concrete that has about twice the durability of concrete made from natural sand.

At the present time, in most instances, the U. S. Engineers are permitting the use of natural sand in large structures for the various dams being constructed throughout the country only where it can be used with coarse aggregate produced from either quartzite or granite. They will permit manufactured sand to be used when made from either limestone, quartzite or granite. However, the high cost of sand manufactured from quartzite or granite makes natural sand or sand manufactured from limestone the only consideration when quartzite or granite is the coarse aggregate. With limestone as the coarse aggregate, sand must be manufactured from the same limestone.

Most deposits of natural sand that are found, especially in the middle west, usually fail to meet the gradation requirements and, therefore, manufactured sand from limestone will receive consideration if production cost warrants it. Most natural sand does not contain enough minus 50 to 100 mesh material, and the producer, in order to meet the required specifications, has to blend an ad-mix of the finer gradation. This involves a problem if the ad-mix has to be manufactured and will, therefore, increase the cost of the natural sand. In some instances producers are fortunate enough to obtain a deposit of fine natural bank sand that can be used. However, as many of the large government dams are being constructed in localities where limestone is available as the coarse aggregate, manufactured sand is a *must* requirement and plays a very important role, as it represents about 27 percent of the total aggregates used in the construction of these concrete structures.

The prospective producer will encounter many problems when producing manufactured sand from limestone.

The U. S. Engineers are striving to give the public a concrete structure which will surpass in durability anything thus far constructed, and the result is that specifications are becoming more and more rigid. The slight variation shown in the comparative gradation table which follows is the result of the many tests constantly being conducted by the Engineers in their laboratories.

GRADATION TABLE

U. S. Seive Size Passing No.	Retained No.	Allatoona, Ga. Min.	Allatoona, Ga. Max.	Ft. Gibson, Okla. Min.	Ft. Gibson, Okla. Max.	Harlan Co., Neb. Min.	Harlan Co., Neb. Max.	Ft. Randall, So. Dak. Min.	Ft. Randall, So. Dak. Max.
	4	0	5	0	5	0	5	0	5
4	8	10	20	10	20	5	15	5	15
8	16	10	30	5	25	10	20	10	20
16	30	15	35	10	40	20	30	20	30
30	50	15	33	15	33	20	30	20	30
50	100	10	15	11	17	12	22	12	22
100	200	*6	11	*3.5	10	3	7	3	7
200	pan	†	†	†	†	1	5	1	5
Fineness Modulus		2.40	2.90	2.40	2.90	2.35	2.75	2.35	2.75

*Minus 100 to pan only.
†Not designated.
Note: The average of the percentages of the above figures are desired.

*Designing Engineer for Fort Gibson Dam Aggregate Plant.

Product of hammer mill below bin is conveyed to air separator in background. Hammermill principle serves the function of eliminating slivers and flats

Tests for Manufactured Sand

The tests to which the fine aggregates are subjected in order to determine their acceptability include specific gravity, absorption, soundness in magnesium sulphate, an analysis of

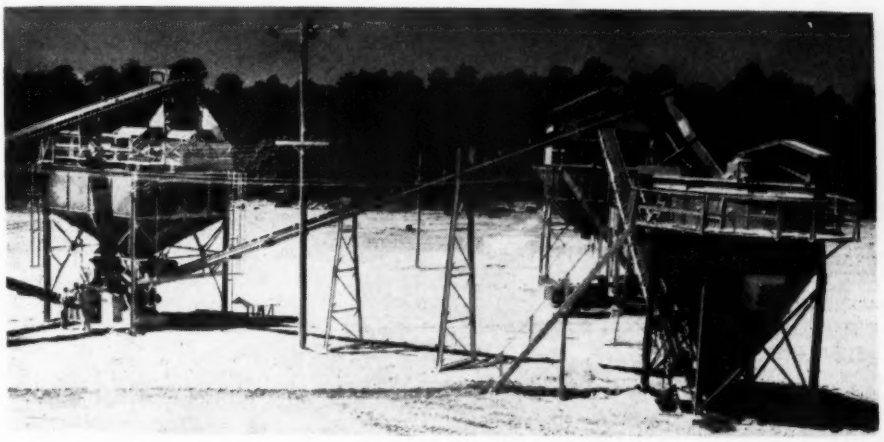
the chemical composition and structure of the material, freezing and thawing in concrete, alkali-aggregate reaction, and in addition the aggregates must pass all gradation tests. Fine aggregate must consist of hard, tough, durable, uncoated particles. The shape of the particles must be rounded or cubical and the sand must be reasonably free from flat, thin, elongated pieces. (Elongated particles are those which have a width equal to one-fourth of the greatest dimension of the particle.) The reason for this specification is that tests have shown that concrete structures with aggregates largely of cubicle particles are far superior in strength—at least 30 percent stronger than those containing numerous thin, flat, elongated particles.

It has been found that a great deal of the natural sand is usually too coarse and does not meet the fineness modulus which is, as a rule, between 2.35 and 2.75. The fineness modulus formula, for those unfamiliar with its meaning, is determined by dividing by 100 the sum of the cumulative percentage retained on U. S. Standard sieves No. 4, 8, 16, 30, 50 and 100.

As an example, the natural sand which the U. S. Engineers contemplate using on the Fort Randall Dam job in South Dakota is far too coarse to meet the specifications without reblending with an ad-mix of minus 50 plus 100 mesh particles made from the product, or the addition of a manufactured product from quartzite, or screenings from the coarse aggregate.

Either method used to prepare the natural sand to meet the specifications presents several problems. Minus No. 4 quartzite or granite screenings will contain the objectionable elongated particles. These will have to be processed with either a rod mill, ring-roll mill, or some other grinding device that will produce a cubically shaped particle. Due to the high cost resulting from excessive manganese wear in producing this type of aggregate, the use of hammermills or impact type crushers which produce cubically shaped particles is not recommended. Whatever grinding equipment is used, it must be of a type which will hold the required gradation limits very closely. The addition to the natural sand of a limestone ad-mix, which could be produced very economically and within proper gradation limits by hammermills is not permitted due to the failure of the mixture to pass the compactibility and the rigid freezing and thawing tests to which all concrete mixtures are subjected. The freezing and thawing test administered by the U. S. Engineers is 300 cycles, which is intended to be equivalent to 150 years of ordinary life.

Since manufactured sand is being produced chiefly from limestone, this article deals mainly with that type.



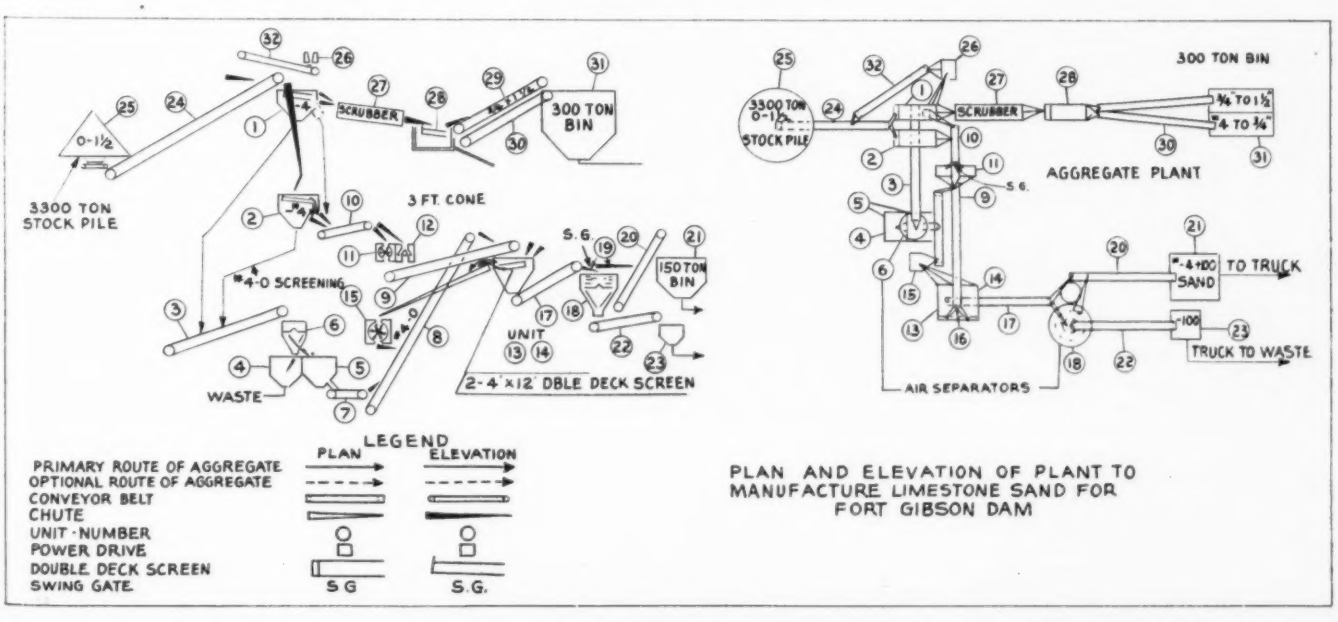
Partial view of sand preparation plant for Ft. Gibson Dam. Fines containing slivery and elongated particles are fed, after screening, to hammer mill under hopper left. Long conveyor feeds 16-ft. air separator through feed arrangement whereby some of the flow can by-pass air separator to conveyor filling bin in background

Producing Limestone Sand

The production of manufactured sand by M. O. Weaver, Inc., aggregate producer for the Fort Gibson Dam in Oklahoma, has been in progress since August, 1947, under the direction of L. H. Peterson, general superintendent on the job, who is ably assisted by his field superintendent, George L. Gibson. E. W. Knapp, of Des Moines, Iowa, is president of the concern.

The author served as designing engineer for M. O. Weaver on this job, and together with Mr. Peterson designed and erected a plant which is operating efficiently in the manufacture of sand and the production of four sizes of coarse aggregate. (An article describing this plant in detail was published in the November, 1947, issue of ROCK PRODUCTS, p. 80.)

Only one minor change has been made in the sand production line to date. The quarry of calcium limestone is being worked in two ledges



PLAN AND ELEVATION OF PLANT TO MANUFACTURE LIMESTONE SAND FOR FORT GIBSON DAM

of approximately 30 and 20 feet each. At the start of the operation, the upper ledge contained about 1 percent silica; however, the silica content in the lower ledge jumped up to as much as 12 percent. Naturally, the manganese wear in the hammermills used for sand production increased correspondingly. It was found that the hammermills were doing their job too efficiently, and an amount of minus 100 mesh material was being produced in greater quantity than could be used. As there was not a sufficient market for disposition of this by-product, it was found advisable to install a 3-ft. short-head Symons cone crusher in place of one of the 40-in. hammermills.

A flow plan of the sand production line for the M. O. Weaver plant is shown (Fig. 1). All equipment used in this plant is Cedarapids equipment unless otherwise specified.

It will be noted that this plant is very flexible and that throughout the entire operation, including the sand production process, there are provided numerous swing gates for diverting the aggregate from one flow line to another. This enables operation of the sand line independently from production of the 1½-in. to ¾-in. and the ¾-in. to No. 4 aggregate. These two aggregate production lines and the sand line are fed from the 3300 ton stockpile by a volumetrically-controlled apron type feeder (No. 25) which delivers an evenly adjusted flow of aggregate to the 30-in. conveyor (No. 24). This conveyor discharges on to the two double-deck horizontal screens (No. 1 and No. 2). At the head end of the conveyor (No. 24) there is a two-way chute with an adjustable swing gate so that the aggregate may be diverted to either screen or divided in any desired proportion. The bottom decks of these screens have No. 4 wire; the top decks, ¾-in. This allows the load to be split over the two decks.

When the 1½-in. to ¾-in. and ¾-in. to No. 4 aggregate lines are operating in conjunction with the sand line, the minus 1½-in. to No. 4 aggregate for the sand line is taken from the surge bin under screen No. 2 and is fed at an evenly-adjusted flow by the 30-in. feeder (No. 10). Should the 1½-in. to ¾-in. and the ¾-in. to No. 4 aggregate lines be inoperative on the final washing and sizing end, the aggregate may be diverted also from screen No. 1. At such time, since the sand line produces about 60 t.p.h., it is necessary to adjust the output of the feeder (No. 25) so that the capacity of the sand line will be sufficient to maintain the required production. At different periods of the year, it has been found necessary to run extra shifts on the sand line in order to maintain production at the rates required for consumption at the dam.

The minus No. 4 screenings through screens No. 1 and No. 2 are carried to the 10-ft. Sturtevant mechanical air separator (No. 6) by conveyor No. 3. Here, the minus 100-mesh limestone is removed and deposited in bin No. 4 from where it is trucked to the waste storage pile.

Air Separator Tailings

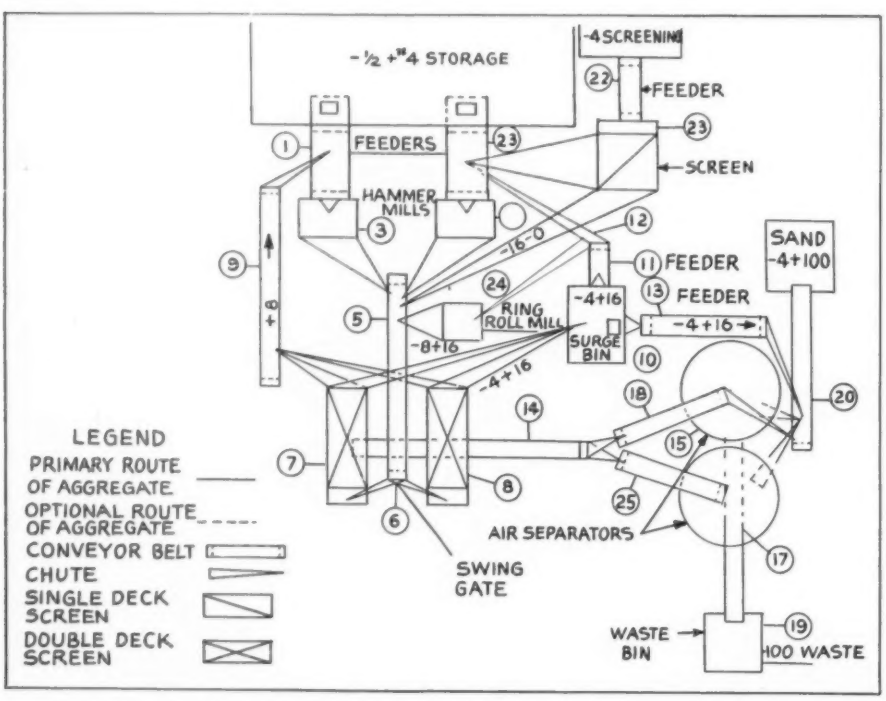
Tailings from the air separator discharge into the 30 ton bin (No. 5) and are then fed on convevor No. 8 into the main sand production line by the 18-in. apron feeder (No. 25). This insures an even flow of material on to the sand line. These fines are produced from the crushers on all of the aggregate lines and contain many slivery and elongated particles. These are introduced into the sand line at this point for further reduction to the necessary cubical shape by the 3033 hammermill (No. 15).

The main flow of the sand line is fed by the 30-in. feeder (No. 10) which discharges into a two-way chute on top of the 4033 hammermill (No. 11) and the 3-ft. short-head Symons cone crusher (No. 12) which is set at approximately ⅜-in. discharge opening. This two-way chute has an adjustable swing gate so that the material may be varied at any time in order to control the gradation which may vary due to wet conditions of the stone and also because of differences resulting from hammer and grate wear inside of the hammermill. The hammermill, equipped with new grates and new hammers, will produce a much finer material than when both become slightly worn. This condition can be compensated for at a moment's notice by regulating the feed—that is, adjusting the feed to the hammermills or 3-ft. cone crusher when conditions require it.

This material is then carried by conveyor No. 9 to the two double-deck 4- x 12-ft. special horizontal screens (No. 13 and No. 14). The bottom deck of one of the screens has No. 4 wire; the top deck, ⅜-in. On the other screen, the bottom deck has No. 8 mesh; the top deck, ¼-in. At the discharge end on conveyor No. 9 is a two-way chute with an adjustable swing gate for varying the feed on to screens No. 13 and No. 14. This is done for the purpose of blending the aggregate, which is necessary to meet varying conditions such as wetness, and also to compensate for any further slight variation in the gradation of the product from the two hammermills (No. 11 and No. 15) and the cone crusher (No. 12), as well as the tailings received from the 10-ft. air separator (No. 6).

Oversize from the top and bottom decks of both screens (No. 13 and No. 14) are returned to the 3033 hammermill (No. 15) for final reduction, and the resultant material is then returned to conveyor (No. 9), thus closing the cycle.

Throughs from the bottom decks of screens No. 13 and No. 14 are then carried by conveyor (No. 17) to the two-way chute on top of the 16-ft. Sturtevant mechanical air separator (No. 18). This chute also has an adjustable swing gate so that part of the product can by-pass the air separator and go directly, on conveyor No. 20, to the finished sand. The excessive minus 100-mesh fines are rejected by the air separator at this point and discharge on to conveyor No. 22 into bin No. 23 and are then trucked to the waste pile. Conveyor No. 20 carries the finished sand prod-



Plan view of typical sand plant employing principle of splitting sand into two sizes

uct to the 150-ton storage bin (No. 21), from where the sand is trucked to the stockpile at the damsite.

By having flexible controls in this sand line, the superintendent has been able to meet the gradations required on the Fort Gibson Dam job to the complete satisfaction of the prime contractor and the U. S. Engineers, who conduct regular hourly tests at the Resident Engineer's office at the damsite.

The Fort Gibson Dam project is being constructed under the direction of the U. S. Corps of Engineers, Tulsa District, which is under the supervision of Col. C. H. Chorpening, district engineer. Frank M. Newell is resident engineer in charge at the damsite. The prime contract for construction of the dam is being handled by the Al Johnson Construction Co., Minneapolis, Minn., the Winston Brothers Construction Co., also of Minneapolis, and the Peter Kiewit Construction Co., Omaha, Nebr. Oscar McCormick is general manager for the prime contractor.

The sand, together with the other aggregates, is hauled to the dam by large semi-trailer type trucks. The hauling contract is held by Millay & McBride of Waco, Texas, whose superintendent on this job is L. (Fibber) McGee.

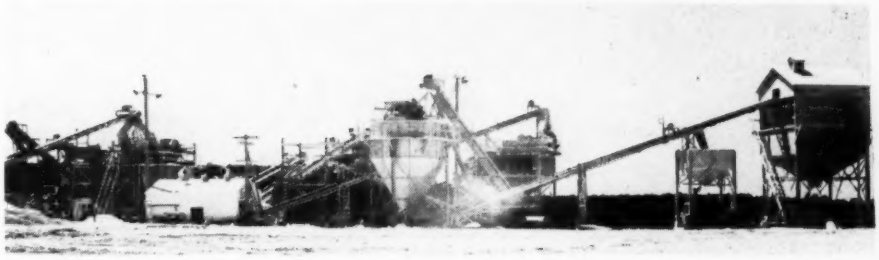
Problems in Processing Manufactured Sand

The process of manufacturing sand from limestone presents many problems in gradation, due to varying conditions of the stone and differences in the composition of the stone within the quarry itslf. The prospective producer must weigh all these considerations carefully, and his plant must be of a flexible design in order to cope with the different conditions as they arise.

Quarry stone should be tested by core drilling at many locations to determine the composition of the stone, especially the silica content, so that the plant may be designed around the proper crushing equipment. It must be recognized that manganese wear increases correspondingly with the silica content, and the differently shaped grains in the stone.

The sand production line must be controlled at all feed points with adjustable feeders so that a uniform feed can be maintained at all times to hold uniform gradation throughout the crushing cycle. Screening must be of a sufficient capacity to insure efficient screening at all times.

In gradation, the most difficult requirement to meet is that for the 30- to 50-mesh size; the 16- to 30-mesh size also requires considerable attention when processing. We have found that the 30- to 50-mesh gradation is the hardest specification to meet because any hammermill or grinding device used will not produce that size in large enough proportions compared to the other gradations required, and in meeting this specification the minus 100-mesh fraction increases.



Another view of sand plant for Ft. Gibson Dam. Excess extreme fines are removed by air separator in center and finished product is conveyed to bin on right

In meeting this specification with hammermills, it would be well to split the sand into two sizes—minus No. 4 plus 16-mesh, and minus No. 16 to 100-mesh and reblend them at the end of the operation. A portion of the minus No. 4 plus 16-mesh material could then be returned to the circuit to build up the 16 to 30 and 30 to 50 mesh gradation.

Hammermills are very desirable in the production of sand manufactured from limestone, as they produce the desirable cubically-shaped particles as well as uniformly grinding the material fine to meet the various gradations. Most important, they have large production capacities.

Great care should be taken in selecting the proper hammermill, since the gradations must be maintained closely all the time. A satisfactory hammermill is one which employs a grinding action as the hammers swing over the grates. Grates are mounted in an eccentric position from the hammers, the hammers clearing the grates about 1¼ in. at the start, and run very close to the grates over the last 90 deg. area. Several of this type, as shown in the accompanying flowsheet, are now being used on the Alatoona Dam, the Fort Gibson Dam, Bull Shoals Dam, and two will be used on the Whitney Dam in Texas. A hammermill that depends upon impact only for fine reduction and in which the grates are installed in a concentric position, cannot be used very successfully as it will be found that this type will produce an extremely excessive amount of minus 100-mesh and plus No. 8 and No. 16 mesh materials.

Markets for Minus 100-Mesh Present a Problem

Like any other crushing device, it is very important that the hammermills receive a uniform feed in order to produce a uniform product, and it would be well to provide variation in speed to compensate for wear on the hammers and grates, i.e., increasing the speed as these parts wear.

The producer must consider carefully whether or not he will have an outlet for the fine 100-mesh material, which can be sold, as a rule, for dust in bituminous road construction, or as agricultural limestone. Gradation for both products varies considerably in different States, and it may be necessary for the contractor to blend some coarser particles with the fine material. This angle should be given consideration, especially if there is a market for this by-product.

If there is no market for the 100-mesh material, to further build up the 30 to 50 mesh and the 16 to 30 mesh sizes, a crushing device similar to the Sturtevant ring-roll mill could be installed to reduce a portion of the oversize that would ordinarily be returned to the hammermills for further reduction.

Whitney Dam

H. D. Bellamy of Concrete Materials and Construction Co., Cedar Rapids, Iowa, materials producers for the Whitney Dam in Texas, plans on splitting his sand production into minus No. 4 plus 16 mesh and minus 16 mesh to 0 sizes. This is to be sized on screens, the required portion of minus 100-mesh material being removed by a Sturtevant air separator at the end of the operation, and the two sizes blended to meet the correct gradation. A portion of the minus No. 4 plus 16 mesh size will be returned to a No. 2 Sturtevant ring-roll mill for further reduction. This is being done in order to produce as small an amount of minus 100-mesh material as possible and thus not overload the capacity of the air separator. The ring-roll mill will produce from 8 to 12 t.p.h. when fed minus No. 4 material; therefore, as outlined above, it's use is only to build up the gradation in the 16- to 30- and 30- to 50-mesh sizes.

When considering methods of removing the excess minus 100 mesh material from manufactured sand, the dry process has some advantages over the wet method with classifiers, the main one being the ease of handling when dry and thereby eliminating the necessity of dehydrating the product.

The air separator lends its use very economically and very efficiently in removing the minus 100-mesh material; however, the producer of manufactured sand should be certain in

(Continued on page 163)

Sand For Wolf Creek Dam

Product from cone crushers, rolls and hammermills blended into sand from which excess fines are removed by air separation

By BROR NORDBERG

METHODS of production of manufactured sand by Cumberland Quarries, Inc., for the construction of Wolf Creek Dam have undergone some revision since production began on the contract well over a year ago, which was necessitated by experience and to keep abreast of changes in the thinking of U. S. Army engineers. The actual grading requirements in force are those written before some of the new laboratory tests have made certain changes desirable in more recent specifications, but they differ little. The allowable deviation in fineness modulus is 0.2 (0.1 up or down) from an established figure which falls between 2.5 and 3.0.

Wolf Creek Dam is on the Cumberland river in southeastern Kentucky near the city of Albany and will ultimately require some 2,500,000 tons of aggregates for completion of the concrete work. Approximately 60 percent of the project is now completed insofar as aggregates production is concerned. Of the total tonnage to be produced, 25 percent will be manufactured sand. The coarse aggregates proportions are 23 percent 6- to 3-in., 19 percent 3- to 1½-in., 15 percent 1½- to ¾-in., and 18 percent ¾- to No. 4 mesh stone.

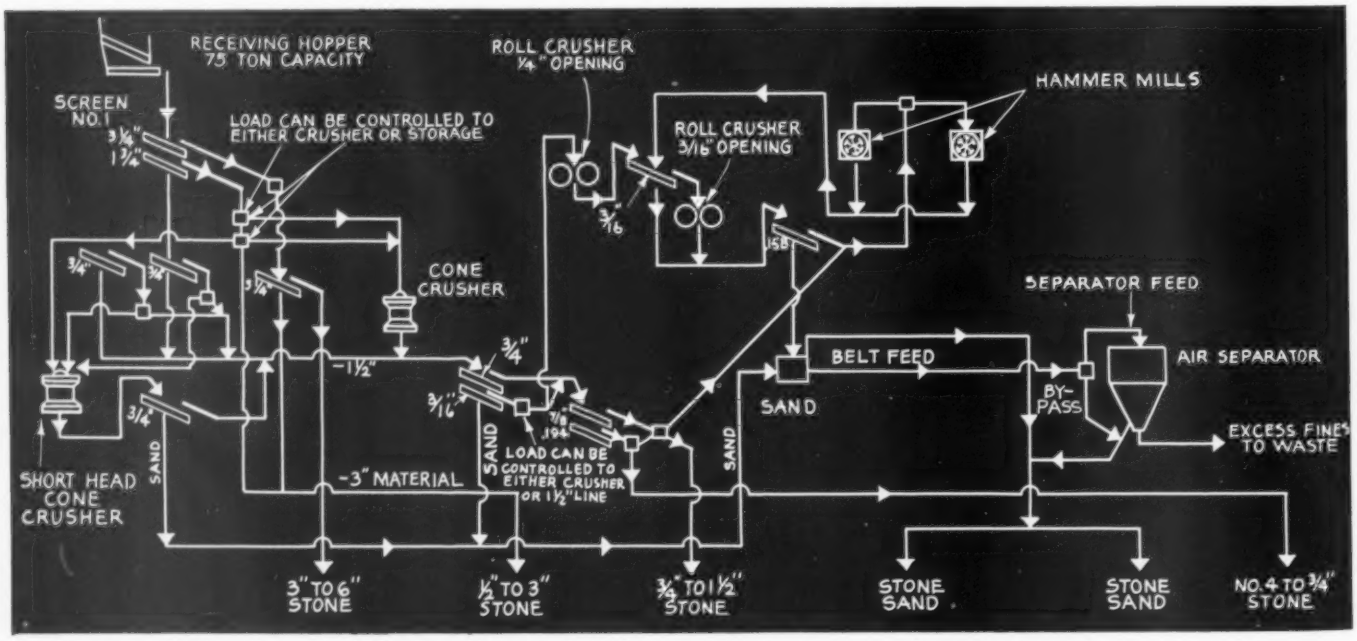
For the purpose of this article we are only concerned with methods to manufacture the sand and changes that have had to be incorporated into the sand flowsheet during the course of the project to correct unforeseen bottlenecks and to meet changed requirements as recommended by the project engineers. The plant overall was described fully in the August, 1947, issue of ROCK PRODUCTS, on pages 106-110.

Quarry Plant Flow

To review briefly and just sufficiently to tie in the production of the coarse aggregates as it relates to sand manufacture, the plant is a straight-line flow operation typical of others that have been built especially to produce aggregates for large dam construction projects. The main crushing and screening plant is adjacent to the project site, set up in a valley, and 125-ft. stacking conveyors stockpile the several separate sizes of stone and sand into piles in a straight row. A single tunnel belt conveyor underneath is the means of withdrawal for transport to the batching plant adjacent. Of the six stockpiles, two are for manufactured sand.

The quarry is 12 miles distant from the project site where a primary crushing and screening plant of 500 t.p.h. capacity was built to produce 6-in. top size material which is hauled by truck to the main crushing and screening plant for final processing. The latter plant is rated 300 t.p.h. of which approximately 80 t.p.h. is manufactured sand.

The stone is a medium hard limestone, 93 plus percent $CaCO_3$, and contains no more than one percent silica which was a factor in the selection of hammermills for part of the processing layout. Two quarry levels are being worked, the upper one with a 30- to 45-ft. face and the lower one with a 90-ft. face. An 8-ft. stratum of argillaceous limestone between must be stripped and wasted. Due to the fact that the upper level quarry has dirt crevices and pockets, a three-deck 4- x 14-ft. vibrating screen was incorporated into the flowsheet at the quarry plant specifically to screen out objectionable material. The screen receives a minus 1¼-in. feed and carries ¾-, ⅝-, or ½-in. mesh dependent upon wet or dry conditions, and the throughs are wasted. Approximately 11 percent of all stone quarried is



Flowsheet of crushed limestone plant. Note provisions for flexibility in routing of stone to major production equipment; also sand conveyor on which are blended sand particles from the various production units

wasted at least insofar as production of aggregates for the dam construction is concerned.

The accompanying flowsheet of the main crushing and screening plant at the damsite is self-explanatory. It will be noted, as indicated on the flowsheet, that there is great flexibility in the selection of routes which a given stream of stone may take as it progresses through the plant. This is important since on a project such as this there can be no provision for re-crushing excesses of various finished sizes of stone. The ratio of production of each specific size must be capable of being held in balance easily and quickly without interruption to production and, furthermore, the selection and arrangement of crushing and screening equipment must be such that sufficient tonnage be "pre-sized" for sand manufacture.

It will be noted from the flowsheet that the principal crushing equipment as such consists of a 4¼-ft. standard Symons cone crusher and a 4-ft. short-head Symons cone crusher, and that two sets of 24- x 54-in. Traylor rolls, a No. 4 Allis-Chalmers Pulverator, a 3XD Gruendler hammermill and a 16-ft. Sturtevant mechanical air separator are the principal sand processing equipment.

Thus, the manufactured sand consists of a blend of sized materials, in addition to crusher fines, from the cone crushers, rolls and hammermills following which excess 100-mesh particles and 200-mesh fines are removed by air separation.

As the plant was originally designed, the cone crushers were to be supplemented by the two sets of rolls in the manufacture of sand, but due to the dual function of the cones which must be set to balance the production of coarse aggregates sizes while producing a great deal of the sand simultaneously and due to the fact that insufficient capacity was attainable at required fineness modulus through the rolls as they had to be operated, hammermills, first one and then a second, were installed. At first, the rolls were closed-circuited with a single-deck vibrating screen carrying 3/16-in. square mesh cloth. An excess of ¼- to 5/16-in. flats accumulated to build up the circulating load in the circuit and one of the functions of the hammermills is to relieve this circulating stream by breaking down the flats into fines. With the production of large amounts of fines by the hammermills, the specified fineness modulus was easily met but then came the necessity to remove excess minus 100-mesh material.

Specifications

The required gradation is as follows:

Percent Passing	Screen
100	¾-in.
98-100	4-mesh
45-80	16-mesh
15-30	50-mesh
4-15	100-mesh

Structure, right, protects air separator. Note covered belt that carries excess fines to waste. Also note two sand stacker belts extending left from separator

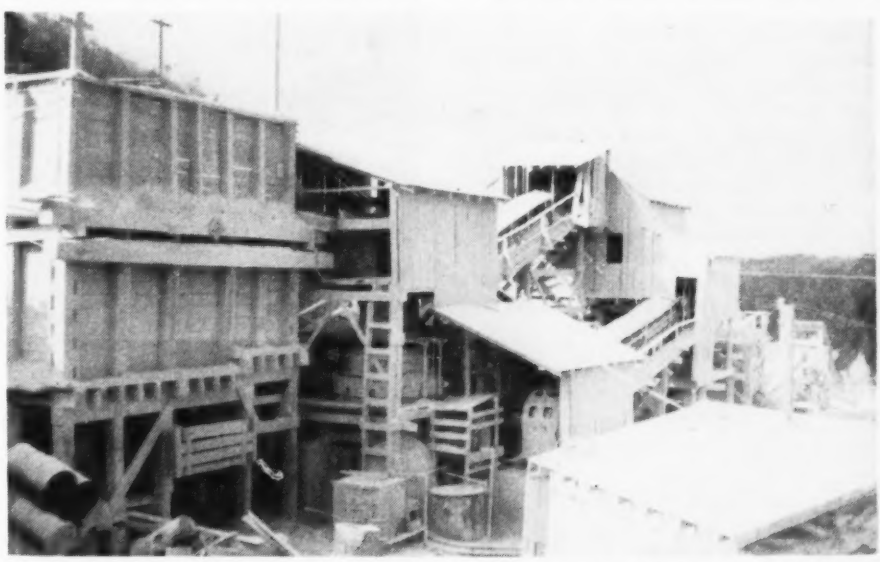
Fineness modulus as originally specified must fall within 2.5–3.0 but production is aimed at a product between 2.70 and 2.90 or at a 2.80 figure. There are no set standards limiting permissible maximum amounts of elongated particles, slivers and flats, but the product must be acceptable in that respect which means that something like 80 percent of the particles must be rounded or cubical in shape. It is preferred that the minus 100-mesh fraction be around 12 percent.

Both cone crushers serve to re-crush any size of stone entering the plant stream and function to balance production of the several sizes of product. Any stone size between 6- and ¾-in. can be reduced through these crushers, for direct stockpiling or to establish desired size for feed into the rolls or hammermills.

At the time we visited the plant recently, about one-half the 6-in. product was being put through the standard cone crusher for further reduction and the balance was being stockpiled. The short-head cone was incorporated into the flowsheet from the beginning because it produces particles of excellent shape, and to produce considerable of the ultimate capacity of sand. Approximately one-half the ½- to 3-in. stream of stone is put through this cone for further reduction, with the balance screened for placement in storage. With this size feed, it produces a ¾-in. product for feed to the roll crushers. The sand as produced from the crusher, as so operated, has an average fineness modulus around 3.06.

Products from the cones are screened minus 3/16 in. on to the main sand belt on which are inter-blended the sand fractions produced later on. Roll feed is 3/16- to ¾-in. stone. Hammermill feed is ⅜- to 3/16-in. stone. Of the total sand blended on the sand belt (see flowsheet) approximately 30 percent is the product of the cones (plus quarry fines), 40 percent from the hammermills and the balance from the rolls.

One of the hammermills produces a coarser product than the other due to the fact that the actual speed ratio



General view of plant from upper end. Trucks from quarry dump minus 6-in. stone to hopper, upper left. Stockpiles of finished material are out of picture to right

Both sand stacker belts issue from common point to left

between the two is 93 to 230 because one has a 42-in. hammer to hammer diameter and the other a 30-in. hammer diameter and they are also driven at different speeds.

Before introduction of the hammermills, with rolls only, the fineness modulus averaged about 3.08 and the sand had 11 percent of particles finer than 100-mesh. The specified fineness modulus was met thereafter but in order to hold down the production of 100-mesh fines, the sand had to be produced on the coarse side and the resultant fineness modulus came on the high side. A blower was tried at first in an attempt to remove fines at the hammermills but was effective only in removing a percent or two of the 100-mesh to 200-mesh and minus 200-mesh fines as shown on sieve analyses. This was soon discarded in favor of the mechanical air separator.

The air separator is a standard machine of the type used by the portland cement industry in closed-circuit grinding of raw materials. The main difference is that it is adjusted for a coarse product and this coarse product—the tailings—is the desired fraction. Usual application is to separate fines from coarser materials but, in this installation, the purpose is de-dusting and removal of the fine fraction according to the setting of the air separator. Approximately one-half of the blend of sands from the cone crushers, the rolls and the hammermills as conveyed by the sand belt, or 50 t.p.h. is put through the air separator and the separator product as de-dusted is inter-blended with the by-passed fraction on a belt below from which the sand is stockpiled. Approximately three percent of the sand, a fraction testing 97.6 percent minus 100-mesh and 85.3 percent minus 200-mesh, is rejected by the air separator and conveyed to waste in the valley. The plant is located in a mountainous, isolated area where there is no market for this product within any reasonable distance.

Summarizing Sand Production

The short-head cone crusher is fed 3- to ½-in. material. An average F.M. of 3.06 with limits of 3.03 to 3.11 is obtained for the sand produced through this crusher. Discharge from the crusher is screened over a vibrating screen with 3/16-in. screen openings. Oversize returns into the flow of material through the mill and the throughs go to the sand belt conveyor.

The 4¼-ft. standard cone crusher is fed excess 1½- to 6-in. stone. Material from this crusher combined with material from the short-head cone and feeder bin, is screened over a double-deck vibrating screen with ¾-in. and 3/16-in. square openings on the top and bottom decks respectively. Material passing the bottom deck goes to the sand conveyor. Any fraction of the material between the two screen decks can be used as feed for the first roll crusher. Material from this crusher is put over a screen with 3/16-in. square openings and the oversize discharges into the second roll crusher (see flowsheet).

Product of this roll crusher combined with material passing the screen from which the roll crusher is fed is conveyed to a single-deck vibrating screen where the size of opening is varied from 3/16-in. down as required to meet the desired gradation. Material retained on this screen is conveyed to the hammermills and the discharge from these mills is circulated back over the screen feeding the second set of rolls. Sand from both cone crushers and the feeder bin, blended with sand produced by the rolls and the hammermills is conveyed to the mechanical air separator where any fraction may be by-passed.

Uniformity of Product

Tests of the sand indicate that a very uniform product is now being manufactured. Typical analyses for nine consecutive samples were as follows:

Minus 100-Mesh	F.M.
13	2.80
11.2	2.97
12.6	2.87
11.2	2.82
11.1	2.85
13.0	2.75
14.3	2.77
11.8	2.79

An actual sieve analysis for a test sample with fineness modulus of 2.798 read as follows:

Sieves	Weight Retained	Percent Retained	Accumulative Retained	Percent Passing
4	0	0	0	100
8	.20	16.3	16.3	83.7
16	.30	26.0	42.3	57.7
30	.21	17.1	59.4	40.6
50	.19	15.4	74.8	25.2
100	.15	12.2	87.0	13.0
200	.09	7.3	94.3	5.7
Pan	.07	5.7	100.0	0.0
Total	1.23	100.0		

The plant is operating on a 16-hr. daily production schedule and has at times been called upon to produce as much as 6000 tons per day, of which 1500 tons would be sand.

Norman Kelb is president of Cumberland Quarries, Inc.; A. B. Johnson is business manager at Albany; and Clarence W. Lowe is general superintendent. Herman Nagel is quarry superintendent; J. T. Allen, screening plant superintendent; and Lee M. Roberts is in charge of transportation.

Top conveyor carries hammer mill feed. Center conveyor delivers feed to air separator, and bottom conveyor carries ¾-in. stone to stacker belt

Progress in Plant Development

GREAT PROGRESS was made in the rehabilitation and building of rock products plants in all classifications during 1948, sufficiently so that no publication could devote sufficient space to describe each installation in detail as it is completed. So, in the pages that follow we have attempted to show pictorially many of the new plants and equipment installations that have come to our attention in planning this annual review issue of ROCK PRODUCTS. We thank our equipment friends and others who participated in the assembly of some of the photographs.

We do not claim that our presentation is by any means all-inclusive but the reproduction of photographs is intended to portray typical and modern plant layout, to point out some new operating ideas and suggest trends. It has often been said that pictures many times tell more than words and have the advantage in saving time for busy readers. No doubt the critical reader will detect interesting details by examining pictures of plants so we have made them large with that objective in mind. There are, of course, other trends than those illustrated.

Trends in Excavation

While all our illustrations of power excavating machinery may not necessarily show, on the surface, a particular trend, it is of interest that the industry has installed so many new units of different types and make. There has been a great deal of old and even ancient excavating equipment in service, and many such units doubtless are capable of continuing to load out material but other factors have outmoded them and are responsible for the accelerated replacement with modern machinery.

For one thing, the industry like other industries is seeking greater and more efficient production per unit of time and man-hours worked, and one of the greatest bottle-necks has been delays at the primary crusher due to bridging. Correcting or minimizing this production-wasting practice is reflected in the selection of excavating equipment. Many bigger capacity primary crushers are being installed down in quarries to be operated in connection with surge piles from which the main plant is fed uniformly at a high rate and without interruption due to delays or shutdowns in quarrying. This trend in plant layout and the greater primary crushing capacity desired in many plants have required that the industry replace out-moded excavating equipment and thus provided opportunity to select correct size for efficient operation.

Blasting-Haulage

During the year, the use of split second delayed-action blasting, and the use of the drop ball for breaking oversize blocks of all classes of stone, even the very hardest and toughest, have gained wider acceptance. For haulage, larger capacity trucks are being adopted. Big tonnage producers are thinking in terms of truck equipment to haul as much as 40, 50 or even 60 tons of material to plants as one way to slash operating costs which is a possibility that might be investigated by truck manufacturers. Large capacity earth moving equipment, much of types developed originally for road-building, is being accepted widely for general material handling.

Plant Layout

In aggregates plant layout, the tendency is to design plants that are more spread out to utilize belt conveyors wherever practicable for intra-plant transportation between successive crushing and screening locations. And throughout, there is increasing interest in feeders and other devices in order to accomplish greater uniformity of flow. This is particularly desirable in feeding primary crushers, where there is increasing use of pan feeders.

Aggregates, Cement, Lime

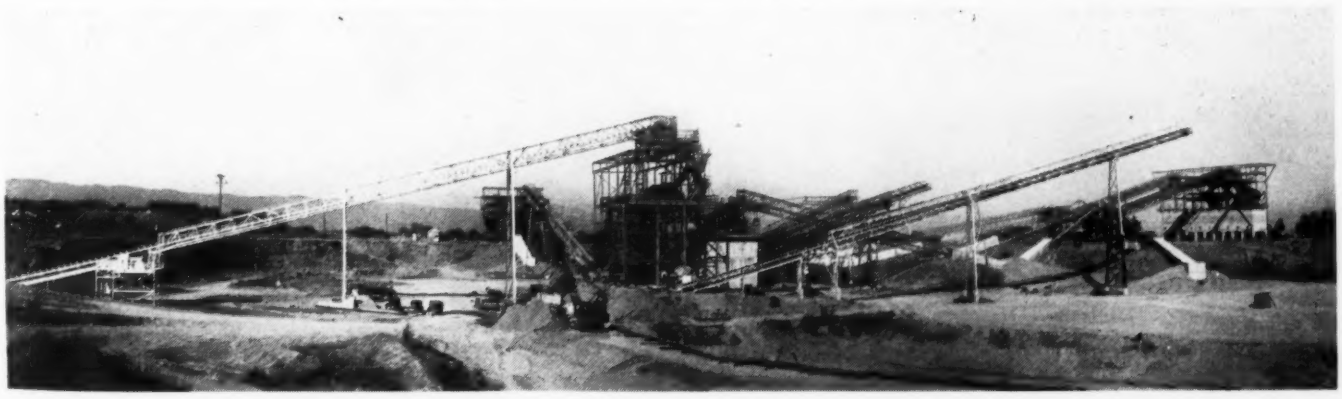
Specifications for aggregates have of course influenced plant design, notably because of a tendency to require smaller sizes of coarse aggregates, which necessitates greater crushing capacity, and much more accurate gradation of natural as well as manufactured sands. The recovery of fines in natural sand remains as one of the difficult problems in sand and gravel plants. Production of manufactured sand to meet highly restrictive specifications is considered elsewhere in this issue.

In actual manufacture of portland cement and lime, interest is principally in conservation of fuel, manpower and power, and many of the plant installations are principally for those objectives. Long kilns with higher speeds of rotation, more efficient grinding circuits, much greater usage of control instruments, more accurate proportioning devices and more thorough blending methods stand out as principal operating goals. In these industries quality of product is equally important to increased efficiency in the objectives of plant installations.

All of the rock products industries are in operation at a high level of production and one of the very real problems confronted by management is ways and means to meet demands without risking too great over-expansion. Consequently, for many companies, the focus is on bringing into balance the various divisions of plant operation for more effective use of existing peak capacity.

In the industries of lesser numbers, phosphate for example, great progress is being made in order to attain maximum recovery and, from the quality standpoint, better separation of minerals through vastly-improved methods of beneficiation.

Considered one of the most modern sand and gravel plants in the United States, the new plant of Pacific Coast Aggregates, Inc., Eliot, Calif., covers approximately 40 acres of ground and features seven intermediate surge piles. Capacity will be 100 tons per hour



Blasting

Showing a delayed action blast at Haverstraw Quarry of the New York Trap Rock Corp. Note the excellent fragmentation obtained through using the split second blasting technique. A careful study of the photograph shows how the bottom was kicked out with considerable fragmentation of the upper portions before the fall

In the photograph at the right, the tool being used for drilling is an auger-like unit, for drilling earth, shales, sandstones and softer limestones. The unit is made by the Salem Tool Company and is known as the McCarthy drill

Multiple drilling with a jumbo featuring an elevated drilling platform is shown here working in the underground limestone mine of Pittsburgh Plate Glass Company located at Barberton, Ohio

New quarry being opened in Wisconsin uses a 315D Le Roi Airmaster portable compressor and a model DR30 Le Roi-Cleveland wagon drill

Excavating

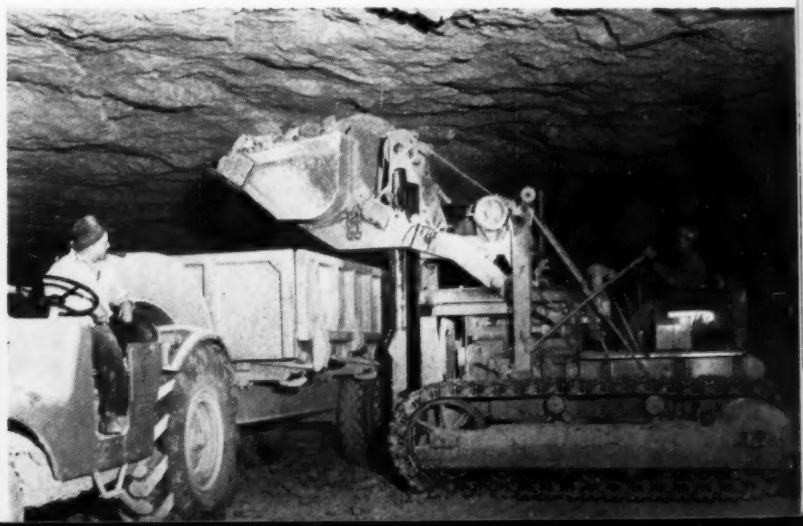
Illustration shows a stripping operation at a midwest portland cement quarry. The Athey semi-trailer unit hauls 7 cu. yd. The tractor is powered by a DW 10 rubber-tired "Cat"

A Link-Belt Speeder K-375 operates a 2600-lb. drag at one of the plants of Consolidated Rock Products Co. of Los Angeles, California

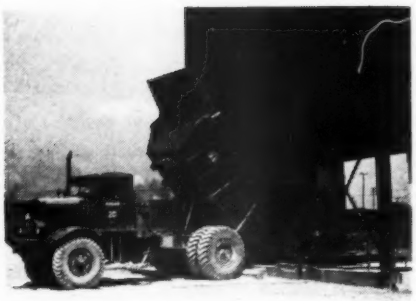
Below: A 6-cu. yd. B-E shovel loading Euclids at El Monte, Calif. of Graham Bros., Inc.

Lower right hand picture shows what can be done with Diesel driven rigs underground. At Creten Stone Products Co., Inc., Turner, Kan., a Diesel D7 Traxcavator is loading into a W10 Caterpillar quarry wagon, also Diesel driven

Carriers of the type shown below are gaining popularity in the rock products industries. Here a 16½-cu. yd. model E16, Tournarocker, manufactured by R. G. LeTourneau, Inc., is being loaded with strippings



At the Overton, Nev., operation of the Nevada Silica Sands, Inc., glass sand is being recovered at approximately 54 t.p.h., using a 2-cu. yd. Sauerman power scraper. A 3-drum hoist, powered by a General Electric motor, drives the unit. The sand in this operation is semi-consolidated



Euclid 7 TD quarry-type truck at the Columbus, Ohio, operation of Marble Cliffe Quarries Co., dumps to the primary crusher. The truck carries 11 tons per axle. During 1948, a great number of heavy-duty haulage units, including semi-trailers, were placed in service in quarries

At the right, working against an 85-ft. bank, a 2-cu. yd., Lorain 820 handles 1500 cu. yd. of trap rock per day at the Orange Quarry Co. operation, West Orange, N. J. The rock weighs 180 lb. per cu. ft. The truck haul is about three miles

At the far right, a small, compact field hopper, which may be readily moved, is served by a 150 P and H shovel. The photograph was taken at the Elkhorn sand and gravel operation of J. F. Thorpe, Delavan, Wisconsin. Portability in pit operations lends flexibility in combination with caterpillar-mounted excavators

Excavation

Part of the operations of Construction Aggregates, Ferrysburg, Mich. Here a Manitowoc 3500 clamshell loads from the bank to barges. These are towed 16 miles down river to the washing plant. A tractor pushes sand to the rim of the pit. The rig loads at the rate of 5-cu. yd. per minute

An 8-cylinder Chrysler industrial 12 gasoline engine provides power for this compact shovel loading rock. Note quarry formation and small amount of overburden at this operation

Shown here are typical extra-traction haulage units

Quarry with low working face (far left) operated by National Gypsum Co. at National City, Mich. Payload of truck, originally a 1½-ton unit, has been doubled with a Thornton drive. Extra traction is important here due to slippery nature of roadway bedrock

Quarry at the left adjacent is a silica rock quarry, operated by Industrial Silica Corp. Shown in operation here is an Osgood, model 801, 1½-cu. yd. shovel

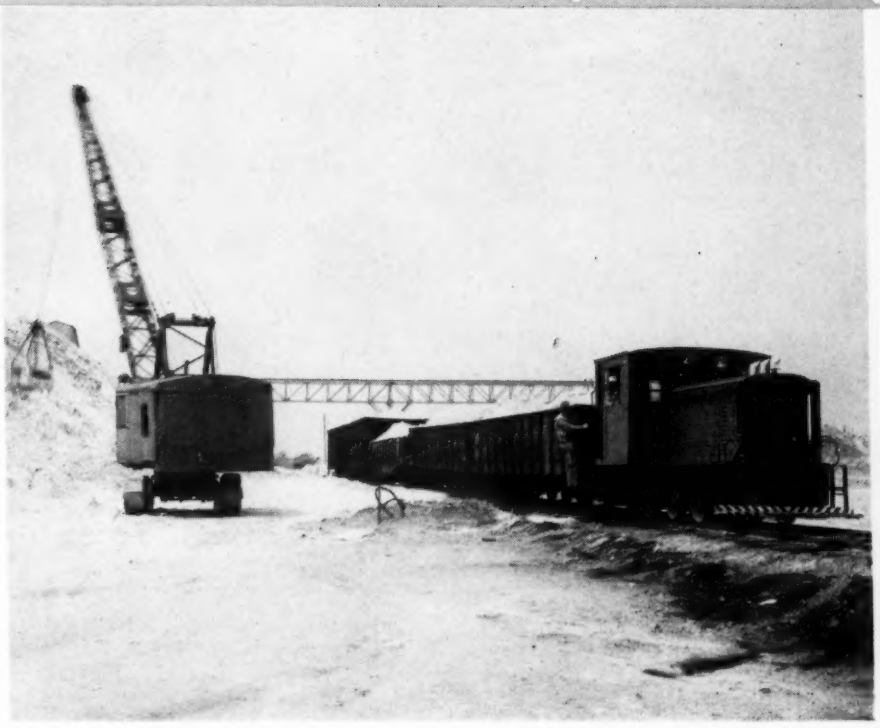
Transportation

Athey rubber-tired trailers, right, carry 12 tons of limestone per load, making 5 trips per hr. on a ¾-mile haul. Power is supplied by Caterpillar DW10 Diesels. The photograph was taken at St. Mary's Cement Co., St. Mary's, Ontario, Canada

At the left, a Le Tourneau, Model C, Turnadozer is moving shale at Diamond Portland Cement Co.'s operation, Middle Branch, Ohio. Note width of blade. Small, high powered machines like this have many applications in material handling

Stripping overburden at Dermot Shemwell and Son's limestone quarry, Carrol County, Ga., using a 4-cu. yd. Bucyrus-Erie scraper. The unit is working with a TD-14 International tractor that mounts a B-E hydraulic bullgrader

A type of haulage unit being used to increasing extent on the West Coast. It was made by Auto-Matic Bottom Dump Trailer Co., and handles 18 to 20 tons of material. A second unit is often used, and pulled by the same tractor

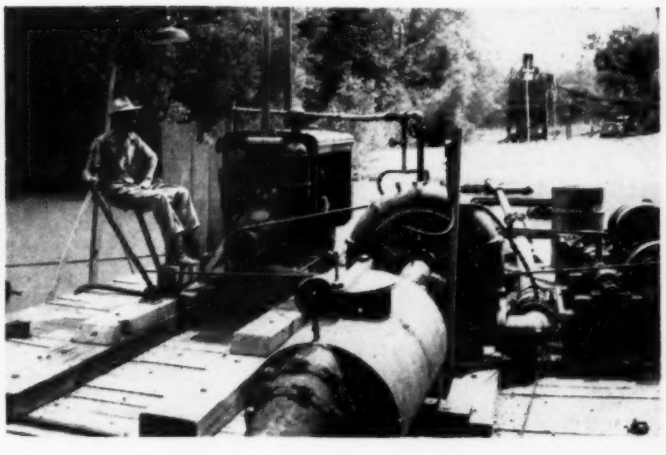


At the Maple Grove, Ohio, operation of Basic Refractories, Inc., this 35 ton, model WLG, Plymouth locomotive is used for car spotting and for switching service about the yard

Crane with a removable rear section which permits close-up digging. This unit was manufactured by Six Wheels Co., Inc., of Los Angeles, Calif., and has a travel speed of 15 m.p.h. which can be to advantage where stockpiles are extensive

A 54-B, Bucyrus-Erie shovel loads limestone at the Consumer Co.'s operation near Racine, Wis. Note yoke of large gyratory, left. Here again we have a plant located in the quarry

Trap on the suction of this Hetherington and Berner 6-in. pump, driven by International diesel, enables the operator to remove oversize. The photograph is of the dredge at the Superior Sand & Gravel Co. operation, Hatfield, Ind.



Stockpiling

New plant of Inland Aggregates Co., Inc., Niles, Calif., is shown in the illustration on the left. The swiveled spout on the conveyor in the foreground builds up four sand piles for drainage. Note swing spout for placing belt discharge in arc around end of conveyor foreground. Dozer is used in stockpile area for clean-up

What may become a trend in the industry is illustrated below. A portable plant is combined as a primary unit along with stationary secondary equipment. The portable plant was supplied by Diamond Iron Works, Inc., and is operated by Central Sand and Gravel Co., Dayton, Ohio

Many small plants, such as the one shown above, are scattered throughout the country. Note the sand recovery system. The Dull (Minneapolis-Moline) industrial rubber mounted "Shove-loader" is rated as ideal for these small operations

Below: Bottom-dump type large capacity haulage unit loading at new Centerville plant of Pacific Coast Aggregates, Inc.

Rubber mounted Browning wagon crane at the left operates in the yard of Consolidated Stone & Sand Co. in New Jersey. This gasoline powered, self-moving clamshell travels several miles per day reclaiming aggregate from different stockpiles

Portables

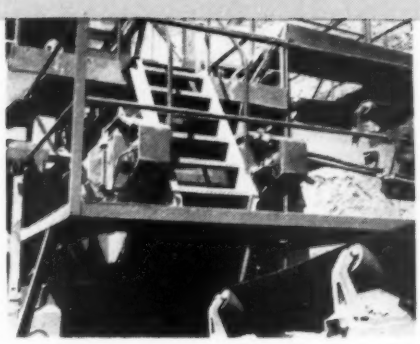
Pictured is a Lippman, self-propelled "Circuit-Rider" that screens, crushes and loads. These machines are said to be the only self-propelled crushing plants of this nature. This machine operates in Northern Wisconsin, producing aggregates for roads

Shown below is a 1-cu. yd. rubber-mounted Hough "Payloader" operated by J. W. Peters & Sons, Inc., at Burlington, Wis. These end loaders are flexible and can move about the stockpile area rapidly. Upper right may be seen a corner of a 5-compartment Blaw-Knox truck hopper. Washing-screen, sand screens and dewatering tank are mounted above the bins

Portable plant, pictured below at the left of the page, uses a novel screening method. The pit gravel is fed to the bottom deck and the jaw crusher output returns to the top deck. This Pioneer 46-VE Diesel-electric unit is in operation at the Winston Bros. plant near Los Angeles, Calif.

A Universal 880-Jr. Gravelmaster employed at the operation of Rosenwinkle & Sons, Fairmont, Minn., This portable is mounted on rubber augmented by jacks. Note dragline charging hopper over swing conveyor, right, that can be moved in an arc to follow the gravel reclaiming operation

Illustration at the right shows rolls with heavy hydraulic jacks replacing jack screws at the plant of the Livingston Truck and Materials Co., San Pedro, Calif.

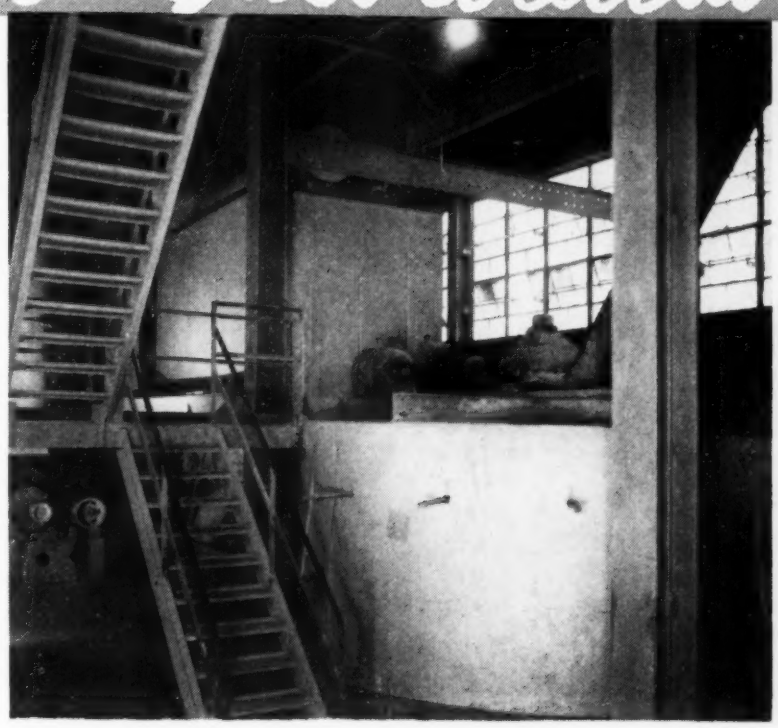


Illustration, left, shows type of earth mover finding much use in the sand and gravel industry, especially in the West. Here Model D Roadster Turnapull with E9 Carryall Scraper dumps sand and gravel to grizzly at plant

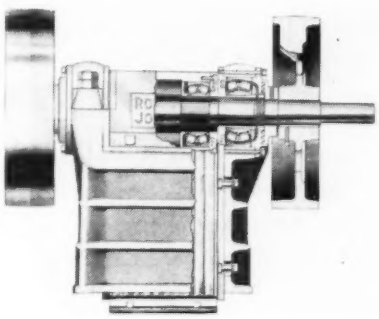
High lift Unit dragline at right loads material to the portable plant of Crystal Lake Trucking Co., Crystal Lake, Ill. This is a No. 1020 machine with ¾-cu. yd. bucket

Type of rubber-mounted crane, left, employed to reclaim materials from stockpiles. This 2-cu. yd. Bay City unit was selected for its mobility by Heichman and Van Every, Northville, Mich.

Maintainance Dust Collection

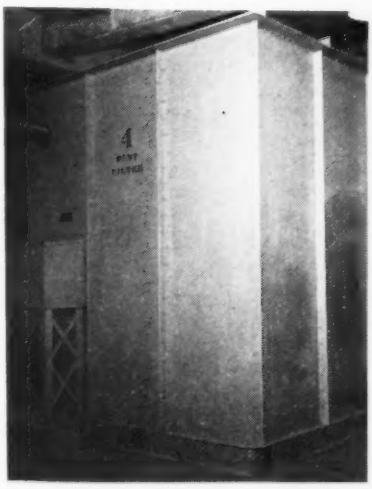


Right: Norblo automatic bag-type dust collector and Sturtevant mechanical air separator, lower right, are insulated against heat loss, in the drying-grinding circuits (2) installed recently by Medusa Portland Cement Co. at Dixon, Ill., for raw material preparation. Fines from the dust collector enter the separator discharge stream for interblending and transport into blending bins.

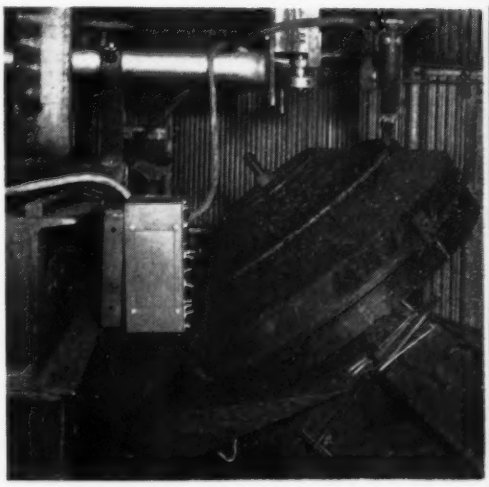


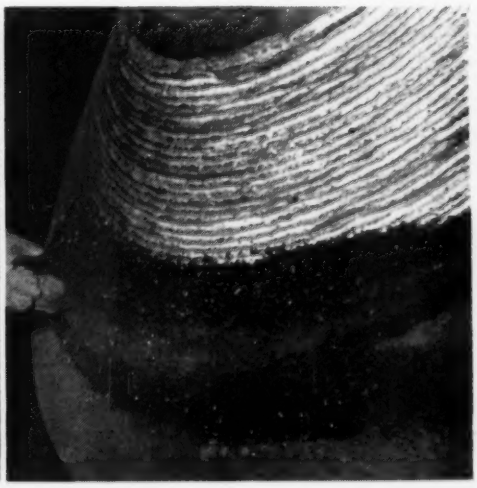
At the left is a cut-away view of a jaw crusher drive shaft showing the application of SKF spherical roller bearings to this type of equipment in the rock crushing field. This is typical of improvements to improve performance of heavy production units

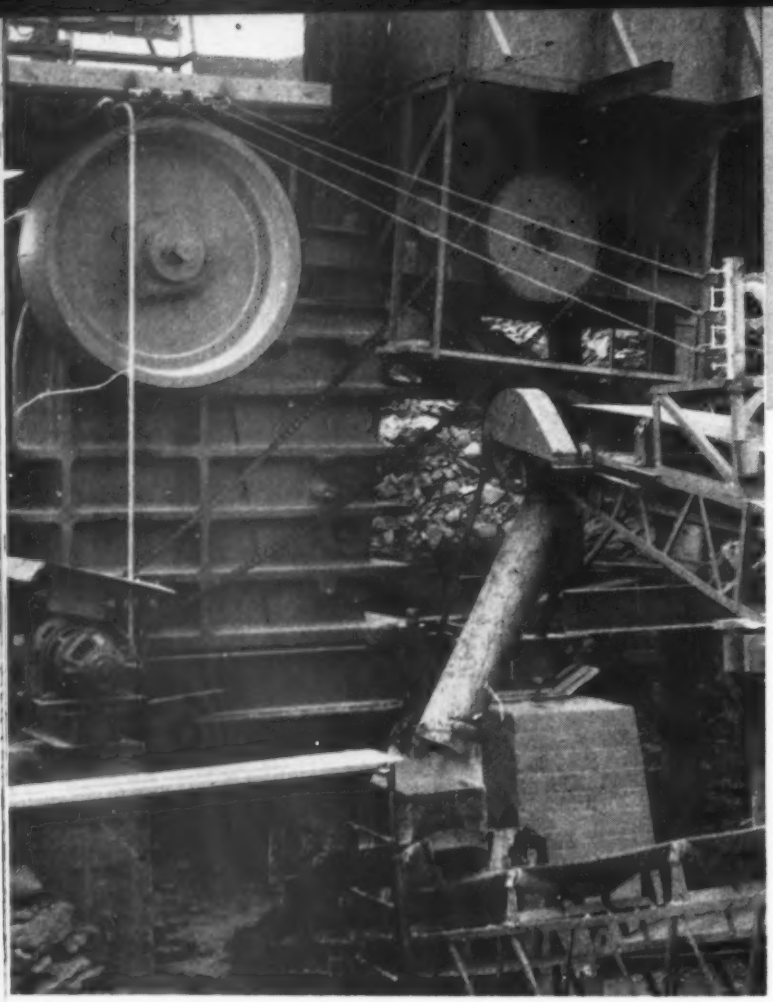
Below: Lone Star Cement Corp.'s new dustless pack house at Birmingham, Ala., features dust filters throughout the plant, which is the trend in the cement industry



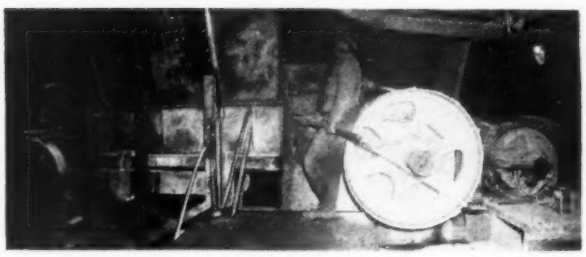
Below: Mechanical application of hard-facing is far more uniform and faster than manual application. Illustration at the left shows a typical set-up for handling a crusher cone. At the right, Stoody 121 is being automatically applied by the submerged arc method. The crusher cone is being rotated at about 25-in. surface travel per minute.



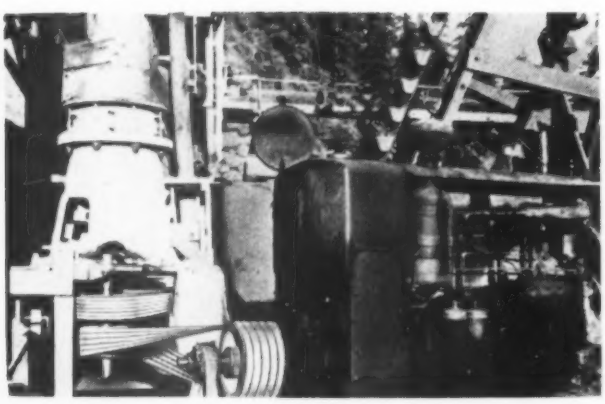




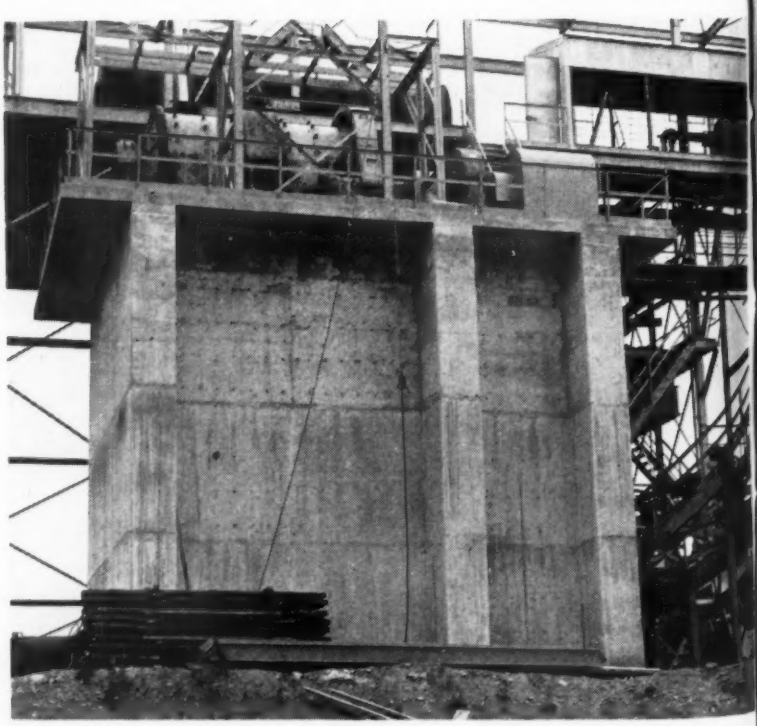
Said to be the world's largest over-head eccentric shaft type jaw crusher, this 36- x 48-in. Lippman crusher is in operation at a plant in Tennessee. Upper left can be seen part of electrical control panel. Note concrete foundations supporting crusher



Underground crushing plant of the United States Lime Products Corp., Sonora, Calif. The 20- x 36-in. Austin-Western jaw crusher is located near the 320-ft. level. The feed rate is regulated by a reciprocating pan feeder

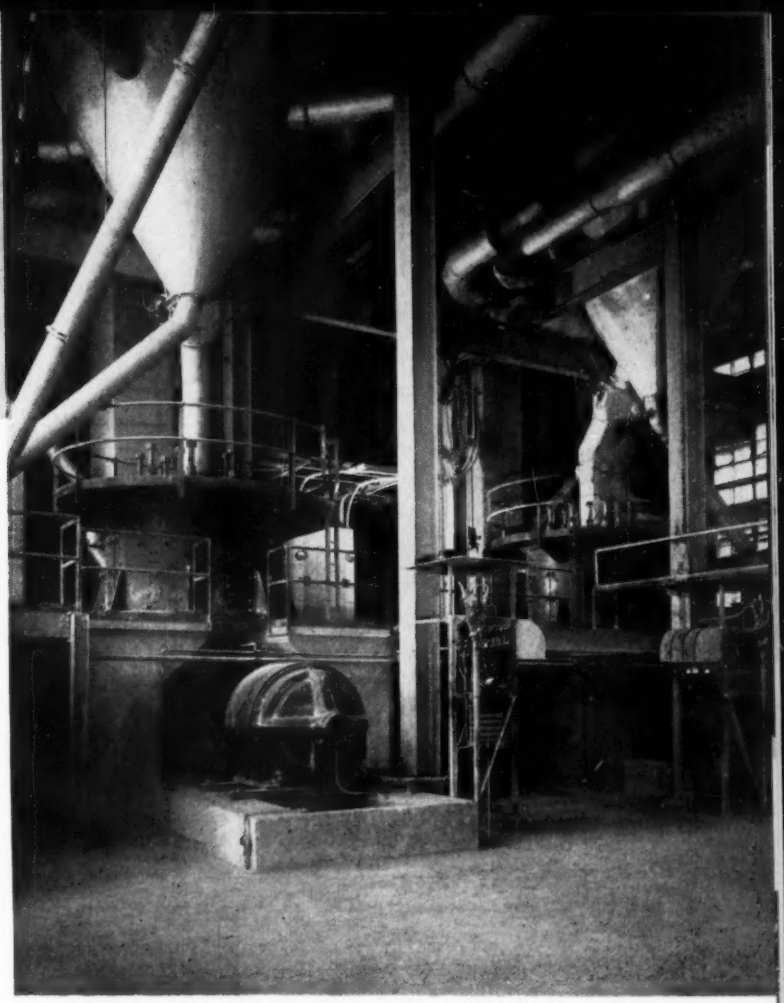


Shown above is a unique "V" belt drive being used at a crushed stone plant in Oregon. The Caterpillar Diesel at 900 r.p.m. runs the vertical shaft of the crusher at 450 r.p.m. using the Gates double return quarter-turn drive shown

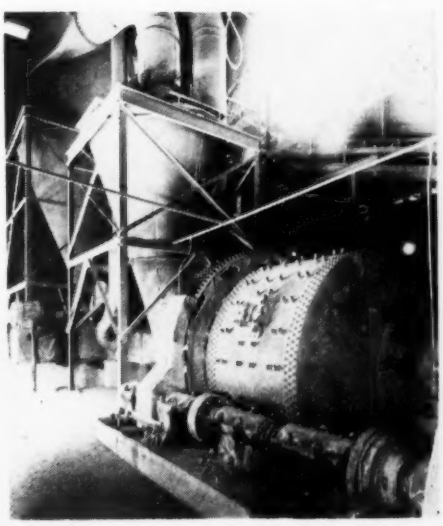


Mounted on a massive concrete foundation that is almost equivalent in height to a 3-story building, is this 8- x 12-ft. peripheral discharge, Marcy rod mill. The unit is in operation at the new plant of Pacific Coast Aggregates, Inc., Eliot, Calif., and will grind pea gravel to sand

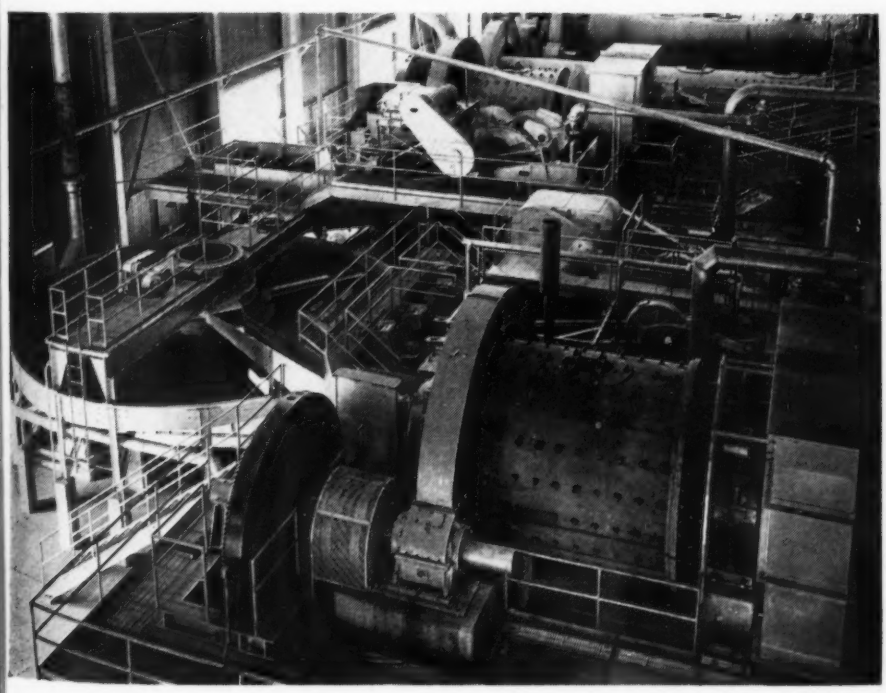
Grinding



First postwar installation of roller-bearing pulverizers closed-circuited with mechanical air separators in the portland cement industry for grinding raw materials simultaneous with drying is shown in the illustration at the right. The pulverizing units are Babcock & Wilcox Co. mills, with Sturtevant separators insulated against heat loss, and the installation is at the Dixon, Ill., plant of Medusa Portland Cement Co.



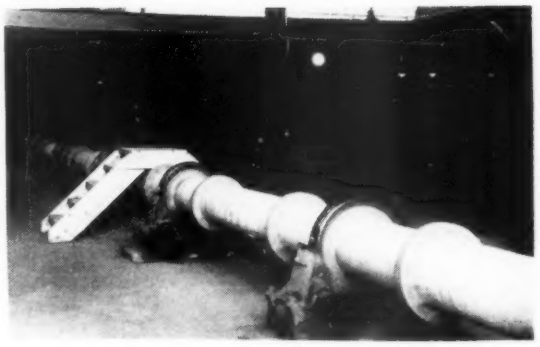
At the right is a 10-ft. Hardinge conical ball mill in use at the Hagerstown, Md., plant of the North American Cement Co. The mill is grinding limestone to 91 percent minus 200-mesh and uses a 12-ft. superfine reversed current air separator



Ideal Cement Co.'s Portland, Colo. grinding mill is pictured at left. The raw grinding is in the foreground with clinker grinding in the back. The large Traylor ball mill that dominates the picture is the secondary raw mill operating in closed circuit with a Dorr bowl rake classifier

Conveying P

A new type of tubular frame conveyor installation is shown at the left. The conveyor was prefabricated on the ground and lifted into place with two cranes. E. F. Marsh Engineering Co. designed the unit which is in operation at St. Charles Sand Co., St. Charles, Mo., for the stockpiling of various sizes of aggregates

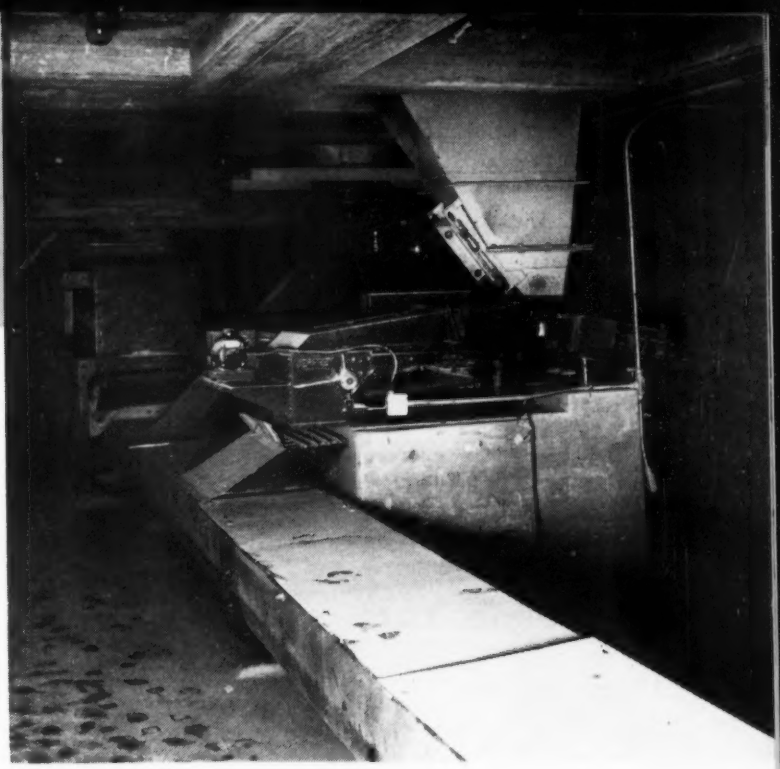


At the right is a Hardinge rotary tubular conveyor which has several possible applications in the rock products industries. Flights inside move the material forward, and the unit is used for handling hot, dusty, abrasive materials. It also can be used for flotation pulps, or to convey and mix or blend materials at the same time

Shown below is Flight "17" of the world's longest "roller coaster," a seven-mile conveyor installation at Bull Shoals Dam, Flippin, Ark. There are 13,888 idlers on the conveyor which will deliver 4,000,000 tons of crushed stone at the rate of 10 tons per minute. All the conveyors were supplied by Robins Conveyor Division, Hewitt-Robins, Inc.

Below, a traveling hopper riding widely spaced industrial rails feeds a belt paralleling stockpiles. This system permits large stockpile area and rapid recovery. The Lorain clamshell is fitted with a long boom

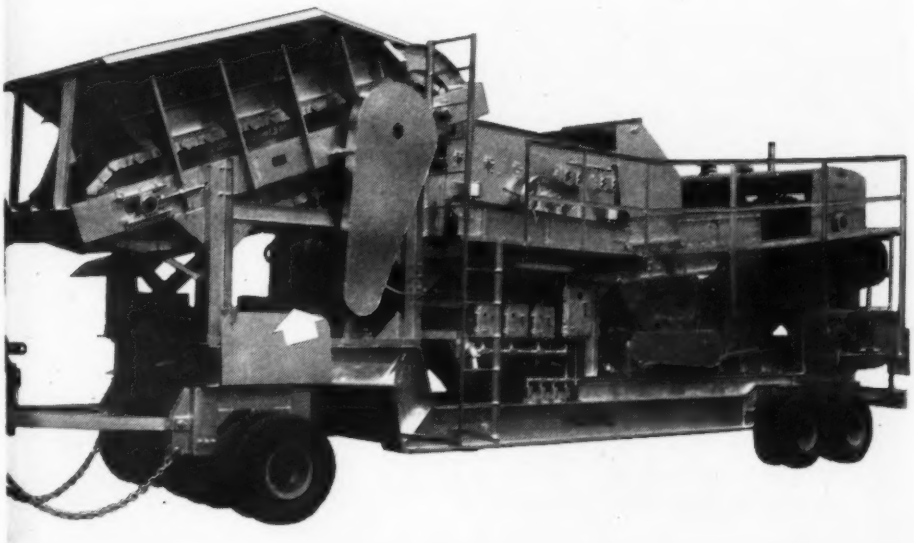
Proportioning



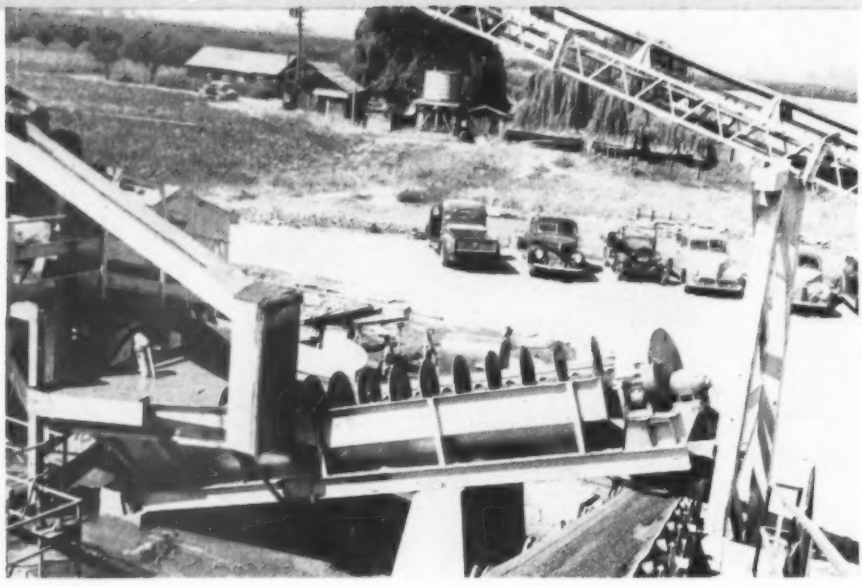
Shown right is proportioning set-up in the recently completed raw mill of Medusa Portland Cement Co., at Dixon, Ill. The electrically vibrated Jeffrey feeder in the foreground is blending clay to an enclosed conveyor carrying ¾-in. minus limestone. Feeders of this type are finding wide application in rock products industries as control devices in proportioning

Novel conveyor system, a product of Homan-Crane Corp., which has possible application for transportation of rock products

Illustration at the right shows the new Diesel driven plant of Manhattan Stone Co., located in Manhattan, Ind. The primary and secondary crushers are each driven by 6-cylinder General Motors Diesels. The plant is producing limestone at 100 t.p.h.

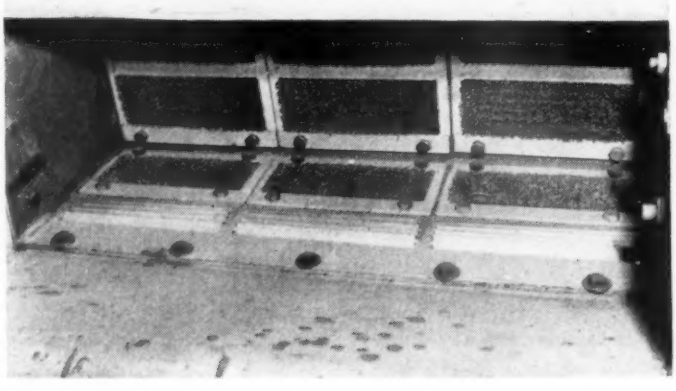


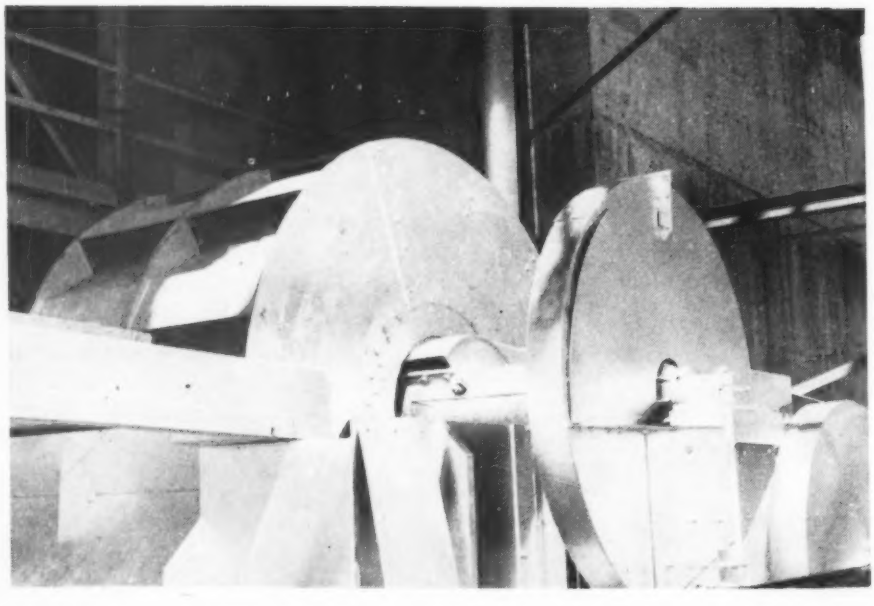
Portable plant at the left, manufactured by Dixie Machinery Manufacturing Co., has a 40-in. x 10-ft. pan feeder with variable speed controls. It features a 36-40, non-clog crusher and pulverizer with reversible hammers. Plant feed control through a variable speed moto-drive has the advantage of quick adjustment to compensate for variations in stone



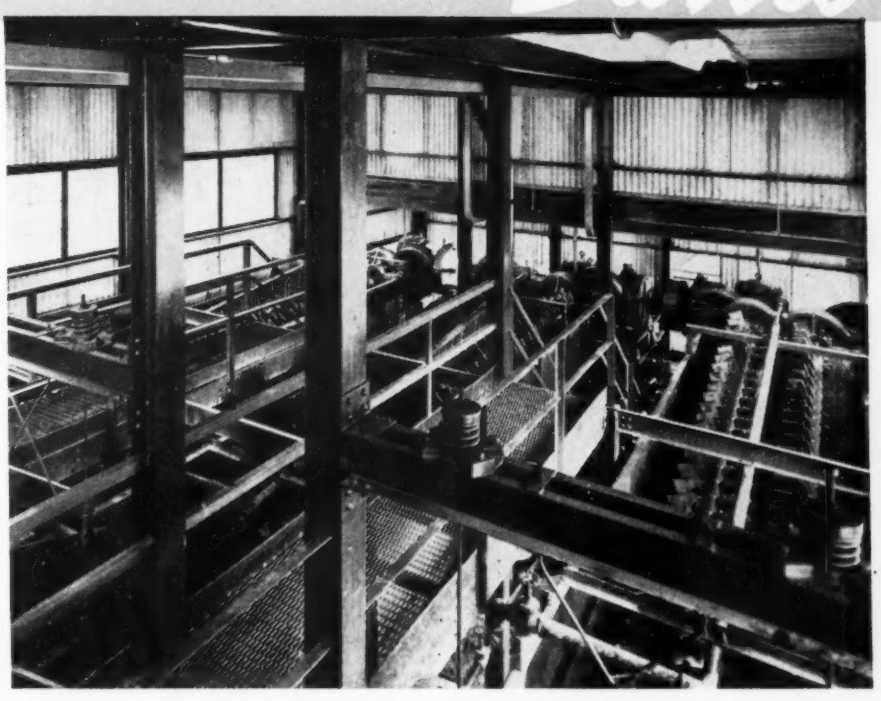
A 48-in. Wemco sand machine is being used in the new Centerville plant of Pacific Coast Aggregates, Inc., near Niles, Calif. This type of machine is very popular on the Pacific Coast, and is recovering around 90 t.p.h. of sand that has a 12 percent water content. The unit is handling 750 g.p.m. of water

Close-up of buckets on Conveyor Co. sand wheels at Pacific Coast Aggregates, Inc., Eliot, Calif., plant. Fiber brushes are mounted in buckets for excess water to drain through in order to minimize loss of fines. Sand wheels like this have large dewatering capacity and occupy little space

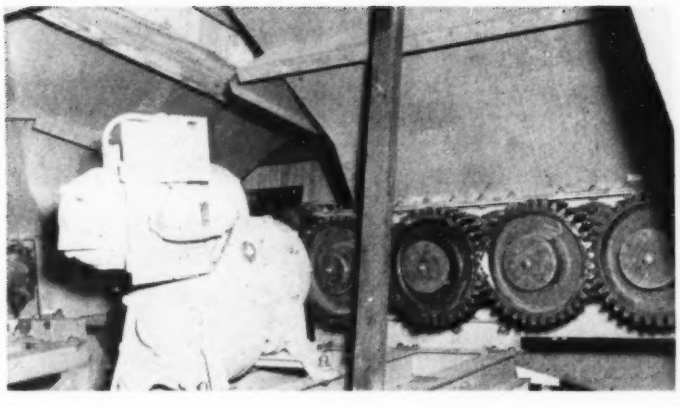




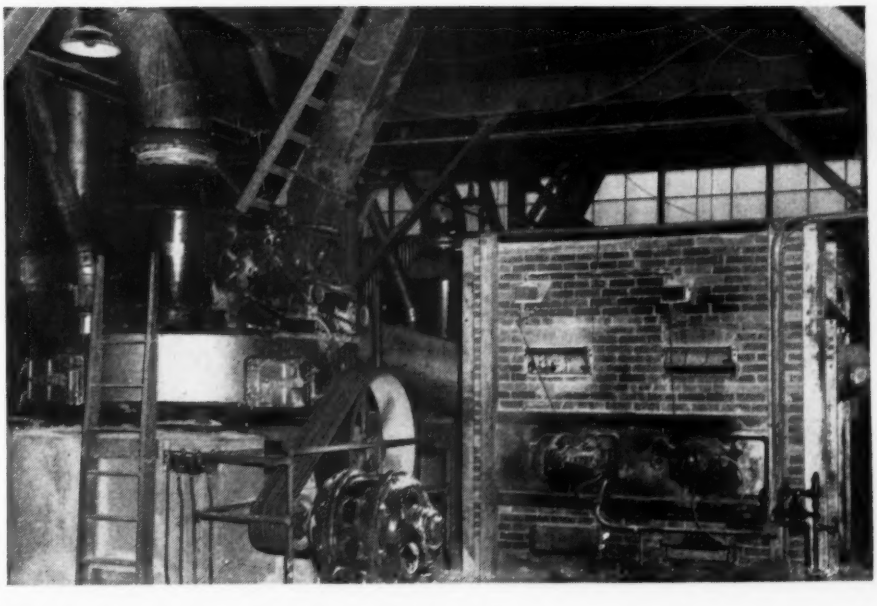
Sand wheel being used at the new plant of Pacific Coast Aggregates, Inc., Eliot, Calif. Bottom and back of each bucket is made of a porous media and a slight vacuum can be applied to de-water the sand. This is said to be the only wheel of this type in the world. The machine is made in Los Angeles by the Conveyor Co.



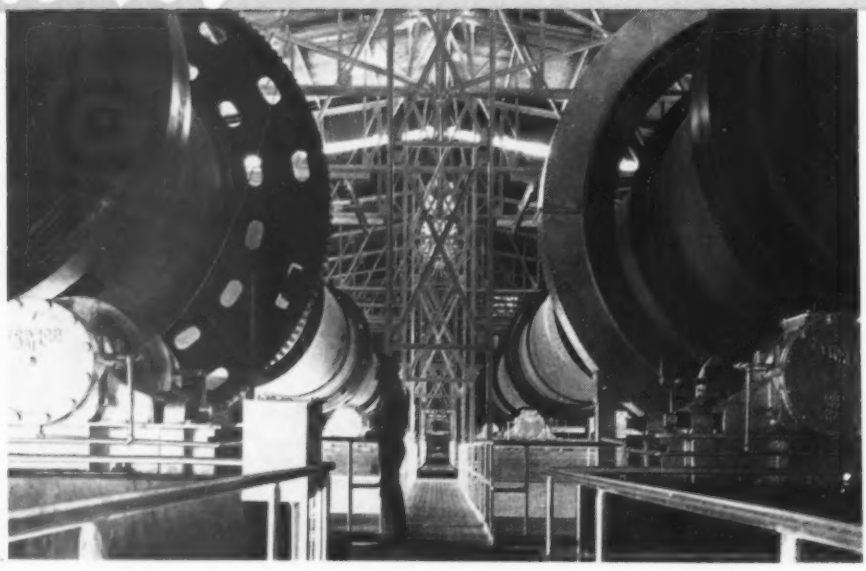
Log washers play an important part in many industries, particularly to remove clay and other coatings as a preliminary step in the washing process. The illustration at the right shows two 30-ft. heavy duty McLanahan & Stone Corp. log washers in the phosphate plant of Swift & Co., Pembroke, Fla.



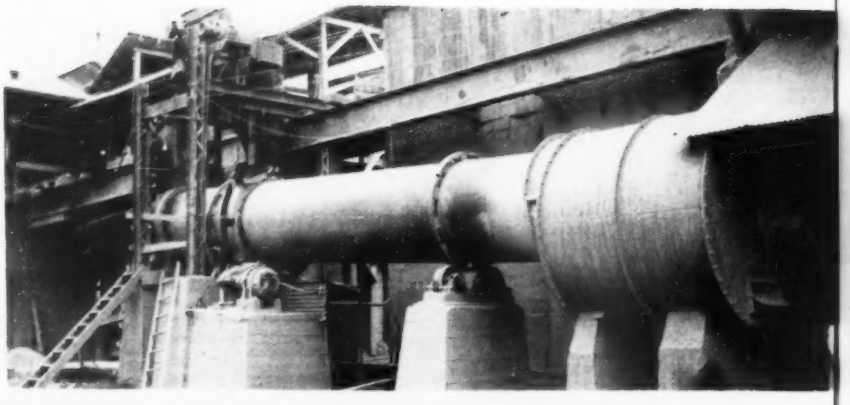
Two finer sizes of sand at Eliot plant, Pacific Coast Aggregates, Inc., are fed to loading and blending belt from bins, bottoms of which enclose heavy screw conveyors to overcome possible arching. New plants, generally are being designed with such details to minimize operational difficulties which have been serious detriments to production in past experience



At the new plant of Western Gypsum Co., Sigurd, Utah, low side Raymond kiln mills dry the gypsum as it is being ground. This increases the mill's capacity, and delivers a relatively hot material to the kettles. This saves fuel and also helps to eliminate contraction shocks to the hot kettle bottoms

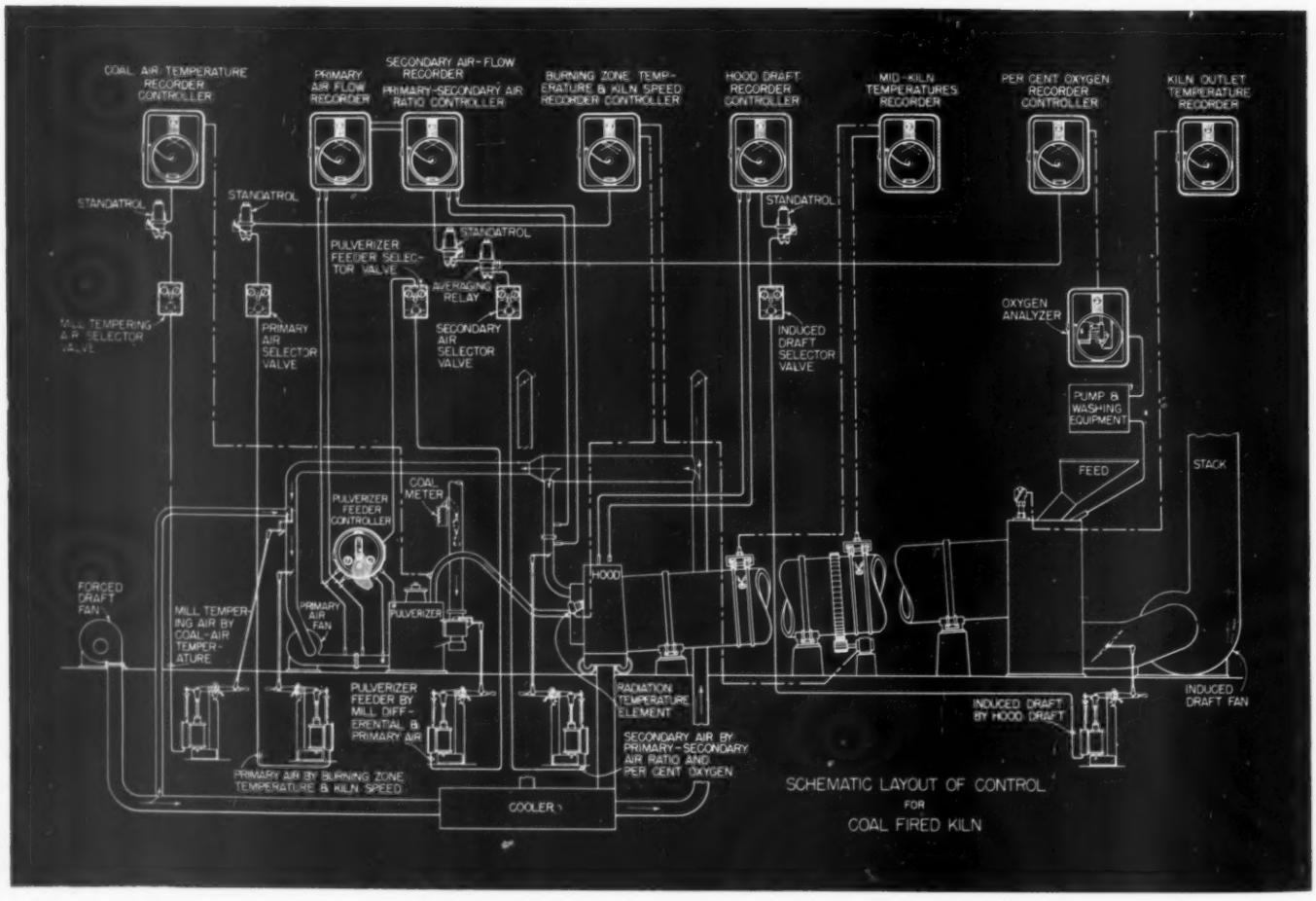


At the left are two 10- x 400-ft. Traylor rotary kilns in the new wet process plant of Ideal Cement Co., Portland, Colo. These kilns are calculated to produce 4000 bbl. of clinker per day

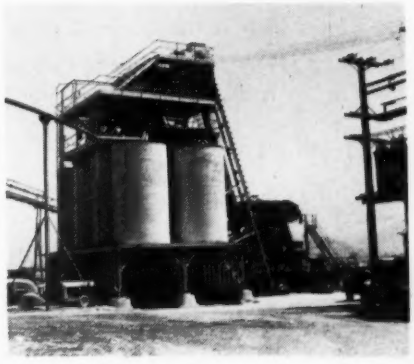


Shown at right is the Hardinge stone dryer with Buell dust collector in operation at the plant of New Enterprise Stone & Lime Co., Ashcom, Penn.

The layout below, of Bailey Meter Co. instrument hook-ups, includes recording instruments for important variables, and complete automatic control of fuel, primary air, secondary air, induced draft, and coal-air temperatures for pulverized coal fired kilns with forced and induced draft fans

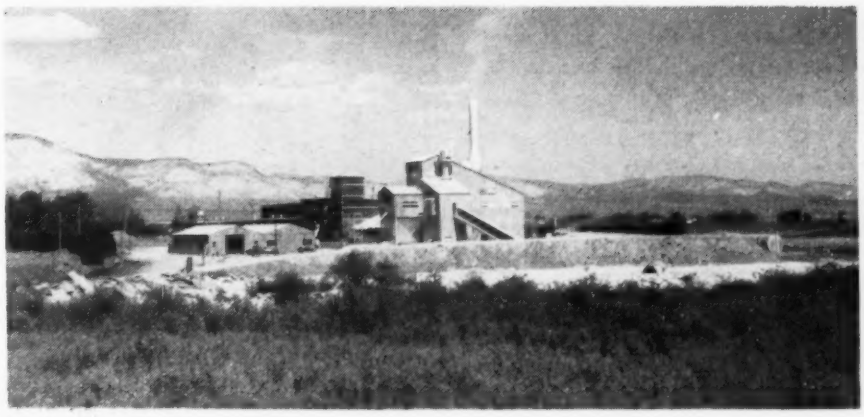


Above: New screening and washing plant of Tom Poppelwell (Fort Worth Sand and Gravel Co.) president of both National Sand & Gravel Ass'n., and Panhandle Gravel Co. The new plant, located at Amarillo, Texas, features a 1536 Pioneer jaw crusher and set of 4022 rolls of the same make



The new plant of the Arrow Rock Co., Roscoe, Calif., was pre-fabricated at the site, so that when the old plant was removed, the new one, shown at the right, was all ready and installed in its place in record time

Left: New aggregates plant of Jones Scott Co., Umatilla, Ore., is shown in distance. A few miles away, the Corps of Engineers is building McNary Dam, a $200,000,000 project just getting under way. Plant is served by field belt conveyors

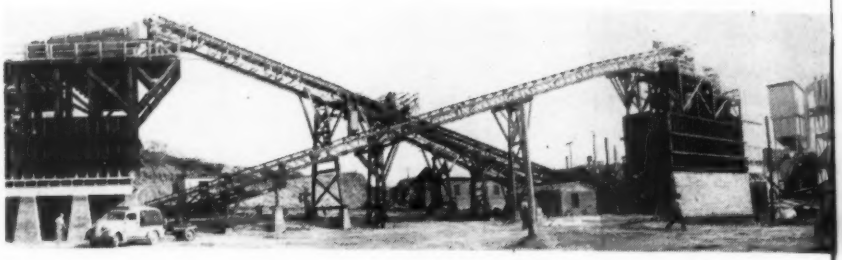


In the picture at the right can be seen the new calcining and wallboard plant of United States Gypsum Co., Sigurd, Utah. Plant is close to new Western Gypsum Co. operation

New Plants

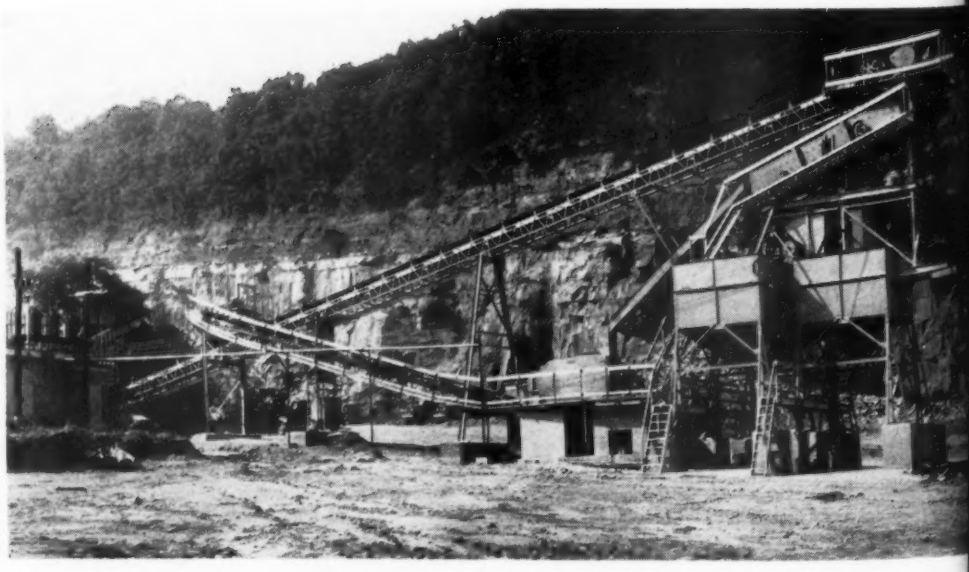
At the left is a wet portable plant being operated by the Texas Construction Materials Co., Houston, Texas. Built by J. E. Ingram Equipment Co. of San Antonio, the plant features a 5- x 14-ft., 3-decked Simplicity screen. It takes about one hour to move the assembly to a new location. The dragline feeding pit run sand and gravel to the plant can then more easily reach it as the cut advances in the deposit

New England states have a just share of new plants completed during the year. The plant at the right is owned by Manchester Sand, Gravel & Cement Co., Manchester, N. H., and features Telsmith equipment



The new plant shown at the left is operated by the Lycoming Silica Sand Co., Lime Bluff Quarry, near Muncie, Penn. This plant can make from 8 to 10 sizes of crushed limestone at the same time at a top rate of 125 t.p.h. Most of the equipment is of Smith Engineering Co. manufacture

Efficient looking plant at the right is owned by the Latrobe Construction Co., Latrobe, Penn. The operation is designed around a Pioneer 3042 overhead eccentric jaw crusher and a set of 54- x 24-in. rolls. It has a capacity of 150 t.p.h.



New Plants

At the right is pictured the agstone plant of F. G. Cheney Limestone Co., Bellevue, Mich. The construction between screens and the bins below is novel. Two Caterpillar Diesels supply the power. The plant is set up to produce road stone as well

Construction of large dams throughout the United States for flood control, power and irrigation is rolling up a considerable total tonnage of construction materials used. Practically all of these dams support a rock operation of considerable magnitude such as is shown in the illustration on the right. This is an operation near the Wautauga dam in Eastern Tennessee

Shown at the left is the new Telsmith plant of the Rockwell Lime Co. at Francis Creek, Wis. The plant is located on the quarry floor, contrasting with many new operations where only the primary crushing unit is in the quarry

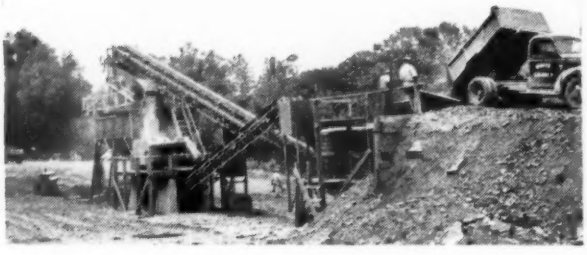
A considerable number of portable plants are located in Idaho. The one illustrated at the left is owned by Carbon Bros. of Spokane, Wash. They use a 6-cu. yd. Koehring W-60 Dumptor in the pit near Emida, Idaho. Note power units spotted at various points throughout the plant

New Plants

Shown at the left is a section of the new Monrovia, Calif., plant of Arrow Rock Co. The bucket elevators shown have a capacity of 120 t.p.h. and the terminals and buckets all are of Chain Belt Co. manufacture

Below: Portable gravel unit featured at the new plant of Guaranteed Sand & Gravel Co., Mankato, Minn. The Universal plant crushes, screens and washes, and features a 1024 crusher and a set of 2416 rolls

Below: Bee Rock quarry, Searcy, Ark., features three International Diesels: a UD-18, 100-hp. on the Pioneer primary crusher; a UD-18A, 125-hp. unit drives the secondary crusher and a conveyor; and a UD-6, 39-hp. drives a screen and a belt conveyor



New plant of Livingston Truck and Materials Co. near San Pedro, Calif., is supplying large tonnages of crushed stone to the harbor areas. It is located on the slope of the Palos Verdes hills overlooking the Pacific Ocean and is a typical "stepdown" plant

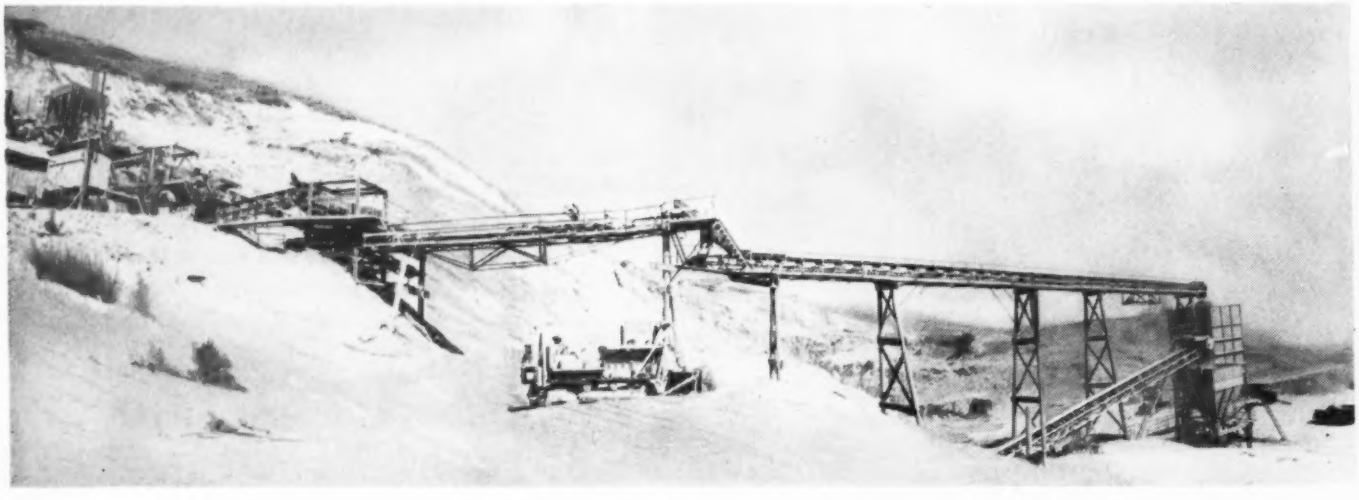
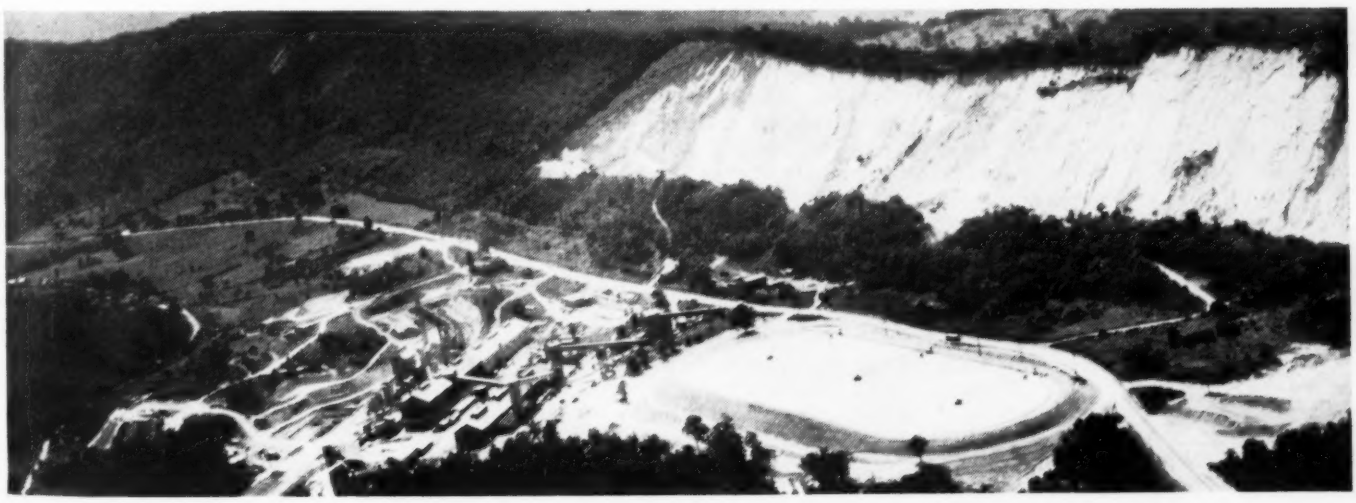


Illustration at the right shows the new wallboard and calcining plant of the Western Gypsum Co., located at Sigurd, Utah. This is said to be one of the most modern plants in the West, and went into operation during the past year

Illustration at the left shows the new plant of Service Rock Co., now under construction at Riverside, Calif. The sections making up the 16 concrete silos were pre-cast. Two Symons vibrating screens are mounted above the bins

Shown below is an aerial view of the plant of the Pennsylvania Glass Sand Co., Berkeley Springs, W. Va. Three 250-ft. Dorr torq thickeners in an oval-shaped earthen basin can be seen. Here 350 tons of fine sand are settled per day from 10,000 g.p.m. wash water



RESEARCH in CONCRETE and CEMENT

Experts comment on accomplishments of research to date and suggest ideas for future study to improve durability of concrete

By BROR NORDBERG

RESEARCH on concrete and its principal constituents, portland cement and aggregates, has many ramifications and has cost millions of dollars to bring the end product to its present state of performance. It is agreed by most authorities that research has been fruitful and that the knowledge so gained in the laboratory has accomplished much in better understanding of aggregates, cement and the art of incorporating these materials into concrete.

In view of the fact that service records of concrete structures are under attack due to evidences of premature failure and disintegration, in many structures, there is a need to re-evaluate research procedure and accomplishments of the past in order to chart the course ahead for an intensified program directed chiefly to achieve greater durability in concrete. In what direction should greatest emphasis be directed in research? Should much of the early work be continued and what are some of the theories that might be explored as possible solutions to the question of durability?

In writing to a selected list of experts requesting that they summarize what has come out of the past 40 years of research on concrete, cement and aggregates and their opinions as to the needs and objectives for further research, we sought suggestions in the light of recent thought, and from some chemists and technologists who we believe have not expressed their views before, either in writing or in technical meetings. There are many qualified men in the concrete industry and related professions who have thought-provoking ideas which they ordinarily would not express openly for reasons of their own and, so, we have obtained some of their comments and observations by promising anonymous use. Of course no symposium on a subject like this would be complete without the considered thought of many well-known and established experts who have been actively engaged in technical committee work and organized research on this subject for many years. Many of these individuals have given us the benefit of their comments.

Whether or not we present anything new herein, this survey, if we may call it that, does disclose that there is much divergent opinion among experts as to what has been accomplished and must be done in research and shows to what extent there is meeting of minds in some respects, notably that durability is the major goal toward which research must be directed.

Among the authorities consulted were users of concrete and its basic materials, including technologists engaged in government service in connection with the construction of dams and roads, highway engineers, university professors. Leading technical experts of cement companies have also participated. Another article in this issue presents the views of the portland cement industry through the Portland Cement Association.

Concrete is, relatively speaking, a new structural material and, during the past 40 years, research has accomplished its objective in bringing to light a scientific knowledge of the material and its principal ingredients that really has been reflected in great progress. Nearly all believe this is extremely important as a preliminary to the second phase of the over-all basic research objective which definitely appears to be ways and means to prolong the life of concrete in service.

It is true that some of the experts say that field tests prove that research has accomplished little toward improving durability of concrete but the large majority do not condemn past research for that apparent shortcoming. With little qualification they are satisfied with progress to date but now are impatient to do something to correct shortcomings now becoming evident as concrete has come of sufficient age to study, and believe the solution to be field study of failures in concrete structures and use of these performance studies as guides to future research.

The water-cement ratio and fineness modulus theories of mix design are of course considered fundamental and basic to good concrete and as being contributory to increased durability of concrete but, in practice, according to some observers has led to the now recognized over-emphasis of compressive strength as being the criterion by which concrete should be judged. These observers say that compressive strength tells nothing about what the quality of concrete will be 10 or 20 years after it has been placed.

It is also generally agreed that research has been of great value in pointing out the need for cements of differing characteristics for use in different classes of service, justifying the manufacture of high early strength cement, low heat, air-entraining and sulfate-resisting cements, and that these specialized cements when used properly will prolong the life of concrete in structures. Substantial progress is credited to research in establishing definite methods and standards for water control, standards for the quality and size gradation of aggregates, proportioning, placing and curing, knowledge of cement components, etc., which no one would argue need be changed. Rather, there seems agreement that all this represents progress which will require continual research in order to approach completion in the search for perfection. This 40 year period has been characterized as one in which the achievements have been quantitative which developed the art of concrete construction into a technical sphere. Methods of standardizing chemical analyses and testing for specific objectives as developed during that period are generally considered as having contributed to progress as are the methods developed through research by which strength can be predetermined in design.

Two significant points were emphasized in many observations we received which have definite bearing on the evaluation generally of research and the rate of progress it can attain toward increasing durability of concrete. It is recognized by these observers that there is great knowledge in the hands of research experts which has not been disseminated to sufficient extent. The other is that very few records have been kept of the nature of materials and methods, handling, curing, etc., used in constructing specific concrete structures so that nothing definitely can be learned about a failure. Failure to comply with good practice for any one of these items could result in

poor concrete. Records were not kept of all the details, our informants tell us, because the builders and purchasers at the time of building saw no reason to do so. The structure in case was considered as one which had permanence and therefore never would have to be examined critically.

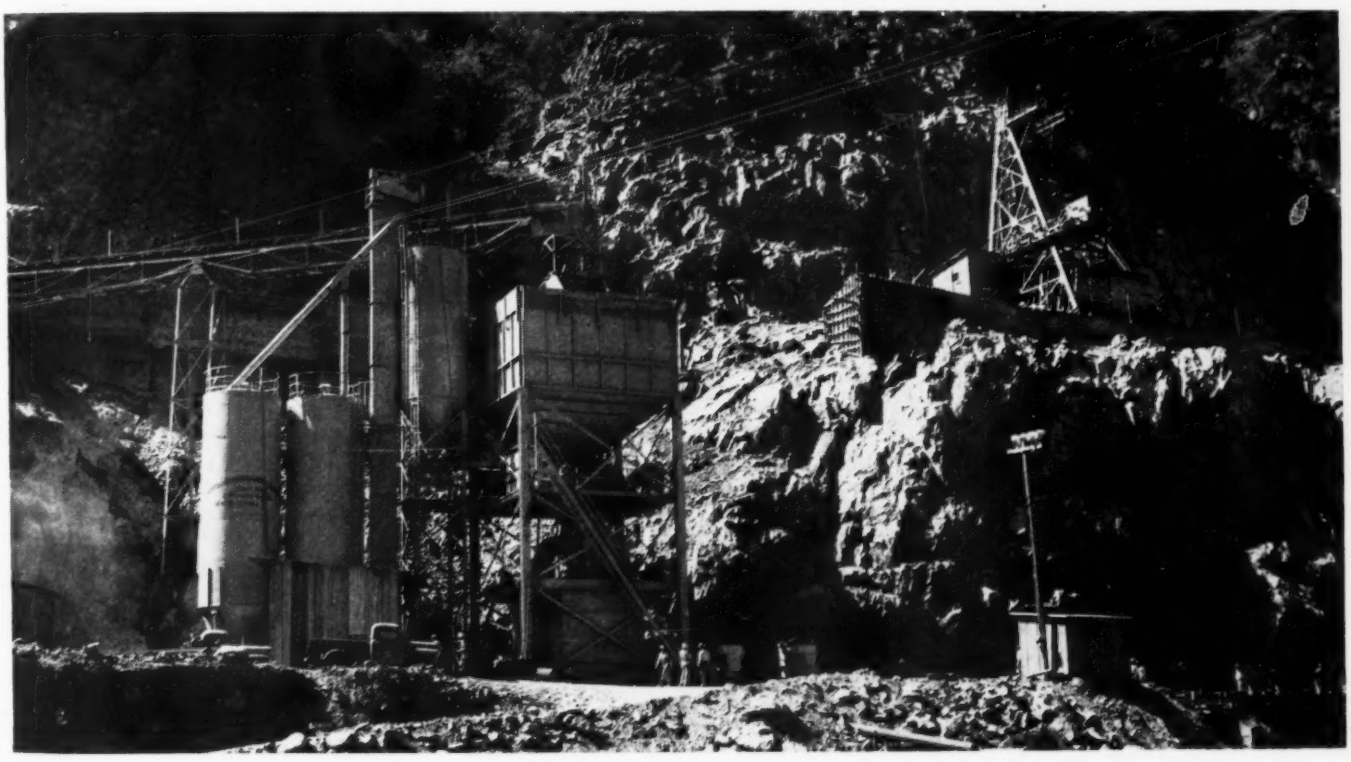
Highway Engineers

Highway engineers express great satisfaction with air-entrained concrete thus far, although many believe that time only will determine whether or not such concrete will have permanence. Some believe that study of all the factors involved in air-entrainment and the resultant concrete is needed above all else in order to attempt to predetermine performance years hence of such concrete. One advantage claimed by several of these users is that air entrainment permits the use of poor aggregates combinations, from the standpoint of character, which may prove an important consideration. Some States and, very likely, local areas in others, are short or running short of first class aggregates and must rely on the use of marginal materials. It is axiomatic that permanence must be accomplished as economically as possible through the use of efficient methods and economically available materials and that users therefore are reluctant to outlaw their sources of supply. These purchasers want to know definitely how great a percentage of shale or chert can be tolerated and how soft particles may safely be tolerated before it becomes necessary to find other sources of aggregates.

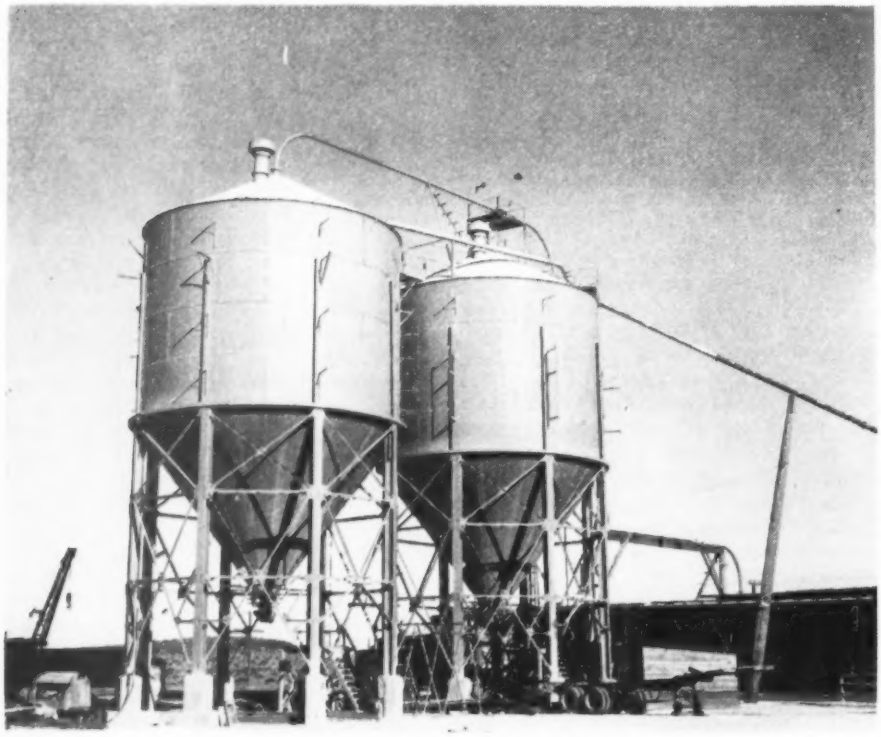
Those who raise the question how durable air-entrained concrete will prove to be, say they know of instances where such concrete has failed after one winter's exposure. Whether or not the pores will fill up with water and resultant freezing result in disruptive action is suggested as a question in need of study. They point to the fact that it is not known how entrained air protects concrete, and believe the sizes of air inclusions are in need of study and that the size and distribution of air voids might be studied to determine gradation just as aggregate gradings have been determined. It has even been suggested that water might be replaced by air for mass structures.

Practically all our correspondents are intrigued with the theory of alkali-cement-aggregate reaction and compatibility in their influence on durability and believe that a great deal of study is required in those fields and on the subject of volume change from forces within generally. The consumer is in need of simple and reliable test methods in order to determine whether or not a given aggregate requires use of a low alkali or puzzolan type cement.

Several technologists stressed the need for tests to predict the performance of aggregates in combination with cement, and positive laboratory methods, in order to determine life expectancy of concrete under specific job conditions. One highway engineer has observed that so-called "green" cement develops low strength at 28 days but that the concrete becomes stronger, later. He believes there is need for studies to correlate the comparative durability of concrete made from green and aged cements and to determine the maximum permissible temperature of the cement when placed in the mixer. Many stipulate the need for correlating research with actual construction practice but point out that research must take into consideration climatic conditions and other factors geographically which have a bearing. It is suggested that one possible reason for unsatisfactory service performance might be because concrete is being made too strong. Our correspondent believes that the increase in strength of concrete, say from 2500 p.s.i. to 6000 p.s.i. the past 25 years, may have been at the expense of other properties. Too much rigidity, he points out, results where resiliency is needed to absorb impact. The same observer believes the brittleness of concrete requires study and that a gel maturing more slowly into a tougher binder might give better results. Other experts point out that defects apparently sometimes become evident after a period when important changes in methods of manufacture of cement as a product have been made. They say that the evidence is in favor of the old type coarser cement which was low in lime and was burned at lower temperature. A cement plant research chemist points out that cement is a much more active chemical today and therefore tends to behave badly when used with unstable aggregate or when mistreated. He suggests that modern cements might yield even better results if the contractor could be in-



Batching plant on a private utility company power dam construction job in California's Sierra Nevada mountains



Storage facilities at the Utah Construction Co., Kingman, Ariz., prime contractor on the Davis dam job under the direction of the U. S. Bureau of Reclamation. One silo contains pozzolan and the other portland cement. Pozzolan is a finely ground, calcined clay processed as an additive to offset alkalinity

duced to accept a product having the slow-setting characteristics of the older cements. Both users and manufacturers of cement, by the way, blame the other for the quick-setting cements when they try to lay the blame for poor concrete on that factor. He further suggests that the use of 15 to 25 percent pulverized puzzolan might offset the bad effects of 1 percent or less combined cement alkalies but that maybe small amounts of organic additives might do the trick. More must be learned of the rapid hydration reactions with modern cements.

Technologists

Expert technologists with the U. S. Engineers, in commenting on the compatibility of aggregates and the alkali-cement-aggregate problem, say that it will eventually become realized more and more that aggregates are not inert and that while concrete may improve with age it tends to degenerate due to the reaction of water with the various ingredients. There is always a reaction between aggregates and the cement paste, they say, which may or may not be appreciated but certainly has not been given consideration in practice until quite recently. If incompatible materials are used, the breakdown will come earlier. A representative of the crushed stone industry suggests that cement is made up of complex compounds which have different setting rates and no doubt each has its own volume change which would warrant consideration, should compatibility of concrete materials become a general requirement.

There is much agreement, and from purchasers of concrete too, that construction practices do not always follow recommended practice and thus fail to profit from the facts uncovered by research. In several instances engineers, while admitting the unquestioned soundness of the water-cement ratio, admit that consistency of concrete is frequently varied in the interests of placeability depending upon structural limitations that hamper placing. Overloads applied even to good concrete structures cause failures, like in the case of many of our highways, for which the materials are unjustly blamed. Under heavy load conditions, it is about time that consideration be given to correcting bad drainage conditions and to providing good foundations. And it is also significant that there is an increasing awareness of the virtue of impermeability of a concrete mix as an aid to resistance to adverse weathering conditions and other forces that attack concrete.

It has been suggested that there may be "subversive" agents in concrete materials including the mixing water as yet undisclosed that may retard or destroy the setting of cement. Small amounts of borax would have that effect, to mention one material, and there may be others.

The foregoing summary of opinion, if nothing else, suggests in general language some lines of attack for future research and definitely brings out that durability is the property of concrete that research must consider first and foremost.

Some of the more pertinent comments are quoted, in part, in the following:

An independent research director said:

"During the quarter century I have been active in the study of building materials, a definite evolution has occurred in the production and testing of portland cement. Where 2000 p.s.i. concrete was standard, now we want at least 6000 p.s.i. Has the attainment of such a strength been secured at the expense of other important properties? Has the development, which has been concentrated along the criterion of the single property of strength, resulted in the production of cement and concrete of well-balanced properties? I am personally inclined to feel that the one-sided pursuit has not always resulted in providing as good an all-around service as it is reasonable to expect."

He suggests that the following be given consideration:

"It is respectfully suggested that the brittleness of concrete be given much more attention from both the cement angle in providing a gel which will mature more slowly into a tougher binder as well as from the structural resiliency.

"In addition, the properties of ratio of flexural to compressive strengths, the tendency to shrink and creep, and volume changes due to variations of moisture content or of temperature should, I feel strongly, receive more attention. It goes without saying, of course, that I do not suggest that the water-cement principle should be disregarded."

Another director of research, outside the portland cement industry commented:

"We are often told that, by and large, the old type of cement gave more durable results than the present-day cements and certain well-known investigators have pointed out that more defects are evident in concrete made after a particular year during which important changes in cement manufacture occurred, thus seeming to point the finger at portland cement in its altered form as the culprit responsible for a number of instances of poor concrete durability. It is my opinion that the weight of visual evidence is more in favor of the old rather coarsely-ground cement, relatively low in lime and burned at a somewhat lower temperature, than for the present-day cements but I express such an opinion with caution for, after all, the proportioning of concrete, the method of placing, and above all, the consistency, have varied a great deal in the last 40 years. Likewise, the preparation of the aggregates and their gradation requirements have varied to some extent

and so we have a number of variables which affect the durability of concrete some of which have a very important influence on its behavior.

"I do not know that it has ever been proven that the old coarsely-ground type of cement was actually more durable than the present-day type but if such proof does not exist, it would seem highly desirable that the cement industry do everything possible to learn exactly what is the truth regarding the durability of concretes made with these respective cement types. No doubt when the present large scale concrete investigations conducted by the Portland Cement Association are concluded much will have been learned on this particular point.

"One prominent investigator has pointed out the excellent durability of certain concrete dams in which the concrete was known to have been placed in a very dry condition, so dry in fact, that it had to be rammed in the forms; as contrasted with the poor durability of concretes which were placed by other means and which were very much wetter in consistency. Perhaps, the only difference in these two concretes, the one dry and tamped and the other wet and poured, is a matter of strength and porosity due to the high water-cement ratio but, should we go further and look into the effect of the volume and size of the pore spaces resulting from any cause? Nor should we neglect the aggregate as is so often done by those who believe that water-cement ratio is about the only influence worth considering among those which affect the strength and durability of concrete."

His suggestions are:

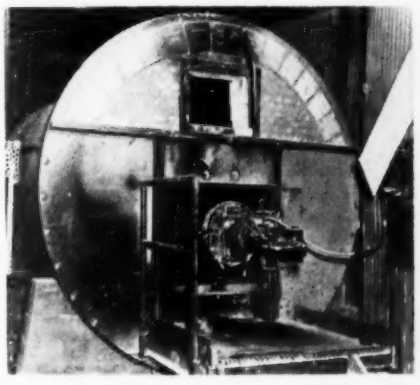
"Research has indicated that lack of durability of concrete may be due not only to freezing and thawing but also to expansion and contraction accompanying temperature changes and to chemical reactivity between certain types of highly siliceous aggregates and the alkali constituents of the cement. Other researchers have shown that the volume and size of pores in the coarse aggregate have a great effect on the durability of concrete under the action of freezing and thawing. These recent researches in coarse aggregates seem highly significant with reference to concrete durability. Much remains to be done, however, on aggregate research, including studies of the effect of roughness of surface, studies of the chemical reactivity between cement and aggregates, certain basic studies in an effort to show the reasons for excessive "blowing up" of concrete pavements and formation of so-called D-cracks in pavements. Some of these studies will involve a determination of the relative expansion and contraction of aggregates under the action of wetting and drying, freezing and thawing and changes in temperature. Some studies of this nature have already been made but many more are indicated as being desirable.

"Only by obtaining data on the basic factors involved, which may affect concrete durability, will a proper explanation of lack of durability be obtained. Such basic data cannot be gathered merely by making freezing and thawing tests on concrete without studying its individual components. Air entrainment in concrete has been a recent subject of study and indications are that a small amount of air in microscopic form greatly adds to the freezing and thawing resistance of concrete; but we should not accept these indications as being final for there are cases on record in which air entraining concrete has shown signs of serious scaling at the end of one winter's exposure. The reason for this behavior needs investigation before air entrainment is accepted as the final cure for lack of durability in concrete. Some investigators question the permanency of air entrainment and it is believed by them that these microscopic voids will finally become filled with water and if this is so, then lack of durability will surely result. This possibility needs investigation and if it is found to be true that complete absorption will ultimately take place then additional researches are indicated to study the effect of construction or design methods for overcoming this excessive absorption. In the case of pavements, this could well take the form of a granular, non-capillary layer such as being used to some extent in pavement construction at the present time.

"The field of research in concrete and concrete aggregates is exceedingly large and there is no question at all that within this field a great deal of constructive work has been done during the past 40 years. Cements have been improved for specific purposes but there is some question whether the ordinary construction exposed to the weather, built with either Type I or Type II cement is as durable as the same type of structure built with cement as manufactured some 30 or 40 years ago. The researchers in concrete and cement should undoubtedly get some definite information on this point for it is important that they know whether they are going in the right direction concerning the changes in cement that have been brought about in recent years, changes made largely for the sake of greater early strengths.

"Cement is composed of a complex system of compounds which set and gain their strengths at different rates and also no doubt have their own separate volume changes in the process. Perhaps these different rates of growth have a profound effect on concrete durability and basic studies along this line might throw light on the subject of proper cement composition for the highest strength and durability. High strength of concrete, in general, can be attained with little difficulty but durability is another matter. Certainly the emphasis should be laid on the various types of investigations which have to do with durability. As everyone familiar with concrete knows, this material is affected by a very great number of influences including the cement, the aggregates, the water, proportioning, the method of curing and placing, influences such as corrosive waters, the action of the weather and in fact so many that only a few may be named.

"Investigations of some of these influences can be ruled out immediately as being of little importance but those which cannot be ignored include basic investigations on cement composition, investigations of the influence of thermal coefficient of expansion of the coarse aggregate as compared with the other constituents in the concrete, the effect of volume and size of pore space in the aggregate and in the mortar, for it will be recognized that pore space is influenced by variations in the water-cement ratio, investigations in the effect of different aggregates on mortar adhesion as this adhesion may be affected by chemical reaction and by degree and shape and roughness, of aggregates, continued investigations on chemical reactivity between alkali in cement and certain types of highly siliceous aggregates. Don't overlook the influence of rigidity of concrete which is measured by modulus of elasticity. Our newer, higher strength concretes have a much higher modulus of elasticity than concretes of former years. This property accompanies their higher strengths. Some thoughtful investigators have said that they would like to obtain concrete, for pavement construction in particular, in which the modulus of elasticity is low but the strength high. This probably is a dream and may never become a reality. Let concrete investigators



Kiln in the new calcining and grinding plant of Eagle Pitcher Lead Co., Clark's Station, Nev. This kiln is used to calcine diatomaceous earth, a nearly 100 percent opaline material which is used as a possible corrective for high-alkali cements

New diatomaceous earth processing plant of Eagle-Picher Lead Co. at Clark's Station, Nev.

not fail to study the properties of water as it exists in microscopic pores. Water changes its properties in confined spaces and that may be important. Don't let us forget either that ice expands much more than concrete when its temperature is raised from say zero to 32 deg. F. This can be important if condensed water vapor or capillarity has filled the voids during the freezing cycle."

An engineer of the federal government comments on the reactivity of aggregates as follows:

"It is my feeling that petrographic and geochemical investigations on the chemical interactions involving portland cement, pozzolanic materials and concrete aggregates are among the most outstanding achievements of recent years. This comment is not intended to detract in any way from the excellent studies on mix design, investigations of clinker composition, etc., but is intended to emphasize the importance of the newer studies on factors contributing to permanence of concrete. Gradually, these studies will eliminate the concept that aggregates are "inert" materials and they will lead to the realization that concrete is a dynamic substance which may improve in quality during a portion of its existence, but ultimately tends to degenerate, largely through the interaction of water with constituents contained within the concrete itself. This degeneration or breakdown can take place comparatively rapidly if the portland cement, mix water and aggregate are not completely compatible. The physical chemistry of this compatibility requires thorough investigation.

"You are completely familiar, no doubt, with most of the results obtained from the studies carried out thus far. Much remains to be done and the problem will not yield a ready or simple solution. In closing, I shall comment on the outstanding value of the laboratory investigations of this type going forward at the Bureau of Reclamation in Denver."

Another engineer, from the Bureau of Reclamation, suggested as follows:

"I feel the paramount need and reason for research today is toward increased durability of concrete. Of utmost importance along this line is the need for improved equipment, construction methods and inspection of concrete placement.

"Research should progress toward improving the chemistry of the final concrete product in the interest of a more stable structure. In addition to the need of the improved materials, the great need of the concrete industry today is improved construction methods, better equipment, better concrete inspection and on-the-job control. We need more field research and less laboratory research. Improved concrete durability costs money and we as users of concrete as a building material must recognize this fact. Little is gained by large amounts of money allocated for research, if such construction practices are tolerated which more than nullify benefits gained by research. Such practices are tolerated in the interests of economy of original construction costs with no thought as to the ultimate or total cost to the user."

An outstanding authority on research on concrete materials, with one of the State highway departments, commented as follows:

"Research conducted by various Federal, State and private agencies has been responsible for the development of the data on the basis of which specifications for the five types of cement have been drafted to accomodate a wide range of weathering and construction conditions. There can be no question that insurance can be secured against possible deterioration through adverse exposures, such as freezing and thawing, sulphate bearing soils or waters, or objectionable temperatures due to hydration, through the use of an appropriate standard type cement.

"A further development of considerable importance is the evidence of adverse reactions between certain cements and certain mineral constituents in some aggregates, combined with the determination that this adverse reaction can, in most if not all cases, be minimized if not completely inhibited through a reduction in the alkali content of the cement, or a suitable puzzolanic addition, or a combination of both.

"One of the outstanding developments of recent years is the benefit of an air entraining agent in improving the resistance of concrete to disintegration through freezing and thawing or sulphate attack, combined with the improvement in workability and reduction in bleeding through the use of appropriate amounts and types of air entraining agents.

"Along with all of the above has come an increasing general awareness of the virtue of impermeability of a concrete mix as an aid to resistance to adverse weathering of any nature."

His comments on the need for research follow:

"With regard to the future, while the developments above listed have gone a long way to perfect our knowledge of and prerequisites for a sound, strong, durable concrete there are many problems to be solved regarding the conditions under which the various modifications of standard materials and procedures are required and what particular modification will best and most economically serve a particular set of conditions.

"For instance, it is well known that many cement companies find it expensive, with raw materials available, to manufacture a Type II, IV, or V or a low alkali cement, whereas some competitor more favorably situated with regard to the composition of his raw materials is put to little, if any, extra expense to comply with any special requirements of the nature listed. Under such conditions it may be unfair and a restriction on competition to unnecessarily specify a special product unless there is reasonable evidence of the necessity for protective measures and that the special product will satisfy the job conditions."

Another authority of international prominence, affiliated with one of the State universities, had the following to offer:

"It seems to me that we have, during this 40-year period, successfully solved the problem of strength of concrete. We can, and do, sucessfully design concrete for any predetermined strength. Regardless of the method of concrete design the concrete technician may use, the fundamental principles involved were brought out in the water-cement ratio law. This is one of the more important discoveries during the period.

"We have not yet solved the problem of durability. We have, however, recognized that it is a problem, and that is a real accomplishment. In the field of durability of concrete and our concrete structures three discoveries have rather recently been made, or the

problem has been recognized.

"1. Recognizing the phenomena of heat of hydration and the necessity of controlling this factor by cement specifications and construction procedures so as to mitigate the effects of internal heat.

"2. Air-entrainment as a factor in controlling resistance of concrete to damaging frost action.

"2. Recognition that there is a chemical reaction between cement and aggregate commonly called alkali-aggregate reaction or cement-aggregate reaction.

"The writer believes that Item 1 (heat of hydration) as it creates construction problems is quite well understood, and that it is now possible to overcome most of the problems caused by this phenomenon. Mr. Lerch has recently found that certain portland cements have a double hump in the heat of hydration curve, and that this characteristic may explain some of the phenomena involved in concrete shrinkage and related durability problems.

"Air-entrainment is now generally accepted as a means of protecting concrete from damaging frost action. There is, however, need for further study in this field. We do not know just how entrained air functions in protecting concrete, just how much is needed, nor the size of the air inclusions to be most effective.

"Cement-aggregate reaction is not well understood nor controlled. The common alkali-aggregate reaction now generally accepted as the complete explanation is inadequate. The reaction is much more complicated than that.

"Recognition of the fact that this reaction does occur is one of the most significant discoveries of the period. Its control will be achieved after further study and research. There is every reason to believe that almost invariably a cement-aggregate reaction occurs in all concrete. In some instances it is bad; in others, good. An inert combination is probably very unusual.

"Recognition of these problems in concrete will promote a critical study of its chief ingredients, cement and aggregate. Cement has been under critical study for some time. Aggregate specifications are entirely inadequate. The common acceptance requirements have little or no relation to its value as an ingredient of concrete.

"It is the author's opinion that until some reliable accelerated durability tests for concrete performance are developed, it will be very difficult to make definite progress in the general field of concrete durability."

A recognized materials engineer for one of the large government agencies charged with responsibility for building dams, commented:

"It is my opinion that the greatest disservice ever done to the country's industry was the extensive use of the slogan 'Concrete for Permanence.' Through the years, the constant use of that slogan lulled the producers and purchasers of portland cement concrete into a false sense of perfection.

"By the assumption that all concrete would be permanent, few records were kept of the nature of the materials and methods used, so that when an occasional example of deterioration was discovered nothing worthwhile could be learned about it. This assumption persists today and I venture to say that from the smallest to the largest piece of construction, few, if any, records are complete. The portland cement may be analyzed, but no record kept as to the exact location in the structure where that particular cement was placed. Seldom, if ever, will all of the other ingredients be analyzed and similar records of placement kept.

"I do not believe enough attention has been given to the study of water and the possible effects of its behavior in concrete. The report by Duff A. Abrams, published in Volume 20, 1924, *Proceedings of the American Concrete Institute*, gives the results of about 6000 tests of concrete in which many different kinds of water were used. The obvious conclusion from those tests was that any water that was potable could be considered satisfactory for concrete, but I suspect there is other information hidden among the data, if nothing more than the indication as to the importance of using concrete under moist conditions which maintained its strength up to 2½ years, whereas dry air storage lowered the strengths of some concrete.

"It is known to many concrete technicians that sugar and borax retard or destroy the setting of portland cement, but we do not know how many other common materials may exist in sufficient quantities to injure the quality of concrete aggregates by ultimately reducing the strength and durability. Such materials might be scattered unevenly and thereby cause a variation in the ultimate life of the concrete. Perhaps this is a fantastic idea, but I have never seen data to prove the contrary, and have never seen a list of 'subversive agents' which might be detrimental to concrete aggregates and water."

A Bureau of Reclamation engineer said:

"I feel that the most significant advances can be made in understanding the chemistry of cement. Cement is so complex that this has been and will be very difficult. Two different cements which as far as the usual physical and chemical tests are concerned are practically the same will produce concrete having radically different properties such as strength, bleeding, workability, and durability. Certainly we do not know what we should when this happens. The alkali-aggregate problem has not been solved by limiting the alkalies in the cement. Perhaps part of this reaction or some reactions may be due to something other than alkali-aggregate reaction. The use of puzzolans shows some promise in this problem. Perhaps the biggest chance for improving concrete lies in education, i.e. educating the average user of concrete in how to make good concrete which includes proportioning, control and construction practice."

The portland cement industry is criticized by an engineer, who commented as follows:

"I believe that the portland cement industry, because of its attempt to thoroughly standardize its product and its promotion of high air entrainment to protect some of the cements meeting their low standard, is doing a great disservice to good cement as well as to their customers."

A professional structural engineer said as follows:

"It is my conviction that we have made so much progress in knowledge of the making and using of cement and cement products that our methods of availing ourselves of this progress have become obsolete. All over this broad land of ours architects and engineers in private practice are writing specifications for the most up-to-date cement, concrete and cement products but fail to write into the contracts efficient provisions for insuring to the owner the securing of the benefits of such progress. Contract clauses are so loosely drawn that most contractors can, and do, violate the provisions with impunity."

An engineer with one of the research laboratories of the Corps of Engineers commented as follows:

"The general trend was once to blame the cement used. While presenting no apology for the cement industry, is it not possible that they have a product that has been much abused because of our being too lenient with our thinking and usage of its potentialities? 'All we have to do is put in plenty of cement' was the thought so widely expressed years ago. This fallacy was proven by D. A. Abrams in his classic papers on water-cement ratios and the strength of concrete. This research study jolted the users and makers of concrete by placing the emphasis on workability and consistency, by the introduction of water-cement ratios, as a means of controlling concrete rather than the prevailing rule of individual experience. This research study started a trend that has finally led to the exacting specifications for fine and coarse aggregate gradings, the minimum-maximum cement contents, and the minimum-maximum water-cement ratios allowable for any portion of the structure under construction now

(Continued on page 144)

Industrial Sand Producers Meet

National Industrial Sand Association Considers hygiene, legislation, freight rates, labor and technical problems

NEARLY 100 members and wives attended the semi-annual meeting of the National Industrial Sand Association, October 20-22, at the Greenbrier, White Sulphur Springs, W. Va.

According to usual custom, the program was so arranged that most of the business discussion and formal meetings were transacted in morning sessions in order that time would permit maximum participation in the splendid and diversified outdoor recreation facilities for which The Greenbrier is famous. Ladies' and Men's golf tournaments were held, there was a bridge tea for the ladies, and entertainment each evening for all in attendance at the meeting.

The Association will hold its 1949 annual meeting at The Homestead, Hot Springs, Va., May 11-13, and will again have a Fall meeting at The Greenbrier, October 12-14 in 1949.

Principal topics discussed were developments in the field of industrial hygiene, recent actions in the States affecting workmen's compensation insurance, the recent decision of the United States Supreme Court in the cement case which invalidated basing point marketing, current traffic problems of the industrial sand industry, technical problems and labor legislation. George A. Thornton, Ottawa Silica Co., Ottawa, Ill., president of the National Industrial Sand Association, Sterling N. Farmer, Sand Products Corp., Cleveland, Ohio, vice-president, and C. M. Hardy, Hougland and Hardy, Evansville, Ind., treasurer, were presiding officers for the three meetings.

Technical Problems

Following reading of the financial report which disclosed the Association to be in sound condition, consulting engineer Stanton Walker briefly reported on a number of technical problems. First he told of conferences a specially-appointed committee has held with engineers of the St. Regis Paper Co. to discuss modifications of bag packing machinery for the purpose of reducing dust exposure in packing operations. Several modifications to improve resistance to abrasion and the stopping and starting mechanisms of packing machinery, which would decrease maintenance and dusting, have been discussed but no decision has yet been reached as to the feasibility of suggested engineering changes. Producers of ground industrial sand, according to Mr. Walker, require more than one-half million bags per year for packing their products.

The 10,000 copies of the Manual on Safety in Sandblasting, originally printed, have been exhausted, and the Manual is to be reprinted.

In his discussion of the testing of foundry sands, Mr. Walker enumerated the various committees active in studies of grading, fineness, core tests, green strength and other properties of foundry sand. Much attention has been given the degree of reproducibility of tests under various conditions and, in commenting on work being done to standardize a test sand, Mr. Walker presented data furnished by the Naval Research Laboratory and also made available from various producers of foundry sands. Data as presented showed the effect of method of sieving on mechanical analyses of sand, of re-use of sample on mechanical analyses of sand, the comparison of mechanical analyses of sand for first use with different samples from the same lot, the effect of the sieve shaker on mechanical analyses of sand (cumulative and separate percents), mechanical analyses of the same samples of sand on similar equipment in different plants, and the effect of type of sieve shaker in different laboratories on mechanical analyses of sand. The various tests under the several conditions in general did not disclose much variation in fineness number although there were significant differences observed in critical sizes as screened on various sieves.

Freight Rates

T. C. Matthews, chairman of the traffic committee, reported briefly on the effects, should recently-requested further increases in freight rates be granted rail carriers. The Association and its special committee believe that discrimination would be the result if freight rate increases requested be granted for bonded molding sand when shipped in box cars. The result would be a 15 percent higher rate than for sand as shipped in open cars.

Wm. W. Collin, Jr., Commerce Council for the Association, said that the latest requested increase in freight rates, 13 percent over present rates, would bring rates to a level 194 percent of the 1937 level, or 77 percent over the 1945 level. Actually, the 13 percent increase would be 20 percent over 1945 rates. Commenting generally, he said that the I.C.C. has been granting increases much more readily and in increasingly larger amounts than in the past which might mean a disposition to maintain the railroads in sound condition at any cost. The alternatives, should volume of traffic decrease, might be government control of the roads, bankruptcy or subsidies.

Labor-Legislation

Executive secretary V. P. Ahearn, in his consideration of labor matters, discussed regulations announced by the Administrator of the Wage and Hour Division following the decision of the United States Supreme Court in the Bay Ridge Case, the Labor-Management Relations Act of 1947, and reported on the status of collective bargaining negotiations in the

Relaxing at the club house are, left to right, Mrs. C. R. Wolf, Mrs. Jesse T. Morie, Mrs. J. M. Strouss, Mrs. Arnold H. Tanzer and Mrs. A. B. Schlesinger

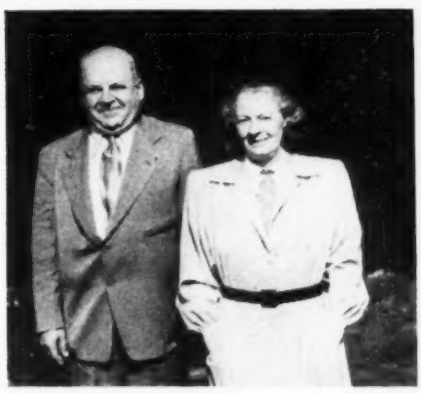
Clayton Devine, Silica Sand Traffic Association of Illinois, Chicago, relaxes before a meeting

industry. Referring to the Bay Ridge case, Mr. Ahearn said that a company has no problem unless work is in excess of 40 hr. per week; that a company then becomes subject to the decision even if shipments are not made across State lines. The Bay Ridge case must be considered if labor contracts call for time and one-half for Saturday work and double-time for work done on Sunday, or where premium pay is provided for holidays worked or for work before 7 a.m. or after 5 p.m. on regular work days, etc. For the purpose of computing over-time payment due, it was pointed out that each week is considered separately. The safe course recommended was that the payroll work week in all cases be started at 12:01 am. on a Monday.

Recognition of the Taft-Hartley Law and its rulings is being evidenced by the labor contracts being signed by industry members, said Mr. Ahearn. The law will not be repealed and probably is unlikely to be changed, at least radically, because it is basically sound. Mr. Ahearn emphasized its soundness by pointing to provisions in the law that protect employes as well as employers and which do not permit individual workers to be helpless in the hands of unscrupulous union leaders while also protecting the public interest by outlawing violence. In commenting on collective bargaining, Mr. Ahearn said that agreements in the industry are generally sound. He emphasized that an individual employe must sign an agreement in order for an employer to deduct union dues from his compensation. In no case should special union fees, assessments or fines be deducted.

Arnold H. Tanzer, New York, N. Y., takes a whirl at the movie camera

At the conclusion of the meeting, Mr. Ahearn was asked to give his comments on the national and international picture and to predict what is in store for industry in the immediate future. He said that with a record-breaking present employment of 62,000,000 persons, there is no pool of men available for war or defense preparations. He anticipates that there will be competition for men in view of the present international situation, between industry for civilian production and for war preparations. There will also be competition for materials. The domestic civilian economy will suffer. He believes that pressure for domestic controls of all sorts will grow stronger and that price controls will be enacted. A new government would even have found it necessary to make a choice between essential and non-essential industries under the pressure that is growing for enactment of controls. There will be pressure for manpower controls in 1949, predicted Mr. Ahearn.



Mr. and Mrs. Henry Roeser, Jr., Millville, N. J., at the first tee

There will be emergencies but he does not believe there will be war in the immediate future unless because of unforeseen incident. In view of conditions, he urged that more use be made of handicapped workers, that an effective working force be built that can be maintained, that plants be put in first class shape and that adequate but justifiable inventory of repair parts be accumulated.

Legislation Covering Compensation

Recent actions in the States which affect workmen's compensation insurance were reviewed by Association counsel Theodore C. Waters. The principal focus has been in the State of New Jersey where two bills had been introduced which would amend the New Jersey Workmen's Compensation Act, and where the New Jersey Department of Labor is preparing a code relating to rules and regulations for the control of silicosis in industry.

Mr. and Mrs. E. J. Campbell, Thayer, W. Va., stop a moment for the camera enroute to dinner

Mr. Waters who has been negotiating with the New Jersey Department of Labor and, with Theodore F. Hatch of the Industrial Hygiene Foundation, has recommended changes to the proposed rules and regulations covering silicosis control measures, which are being given consideration. The proposed code was first drawn up in June, 1948, and was submitted to the New Jersey State Industrial Safety Committee for comment. Comprising the committee were representatives of manufacturing concerns, insurance carriers and specialists. The second draft was submitted in August, 1948, and a third draft is now being written preparatory to formal action. Mr. Waters believes the code will be drawn up in final form on or before January 1, 1949. It will be applicable to all industry operations and all industrial sand producers must comply with its provisions. In Mr. Waters' opinion, industry will be permitted reasonable time in which to comply. He urged that New Jersey producers carefully consider provisions of the code and make certain that their operations do comply.

P. W. Palmer, Browntown, Wis., proved to be another picture fan

Charles G. Runkle, Zanesville, Ohio, left, and T. C. Matthews, Lewistown, Penn., listen closely at the meeting

Mr. and Mrs. R. S. Lebold, Rockwood, Mich.

Mr. and Mrs. W. H. Woodward, Ottawa, Ill.

Junius M. Strouss, Morgantown, W. Va., getting set to slam the ball a mile

He briefly discussed Senate Bills Nos. 196 and 306 which had been introduced to amend the New Jersey Workmen's Compensation Act. The present New Jersey Occupational Disease Act requires that an employe give notice to an employer of contraction of a compensable disease within five months after the date of his last exposure and that he file claim within one year after termination of his exposure. Senate Bill 306 would have changed the law to give notice within 90 days and permit an employe to file claim within one year after he knew or ought to have known that he had contracted an occupational disease. It would have destroyed the defense of limitations in occupational disease cases because it would have been impossible for an employer to prove when an employe knew or ought to have known he had contracted the disease. Mr. Waters was pleased to report that efforts were successful in having the present bill pertaining to compensation for silicosis retained and that Senate Bill No. 306 as passed provides exemption for silicosis and asbestosis in its coverage. He believes the bill will be vetoed by the Governor.

Senate Bill No. 196 has passed the Senate but has not yet been considered by the House of Representatives. It would provide general coverage for all occupational diseases and would have made pneumonoconeoses compensable. Mr. Waters believes that labor representatives will continue efforts to secure liberalization of compensation statutes particularly as to provisions applicable to limitations and disability from dust diseases.

The year 1948 has been an off year for meetings of State legislatures, he said, but the New York State Legislature has amended the statute applicable to compensation for dust diseases, retaining the provision denying compensation for partial disability but eliminating the limitation of monetary liability which was a principal feature. The statute had an escalator clause covering compensation. Compensations now payable for permanent total disability from dust diseases is the same as for any other diseases or injury. This pattern, he believes, will be followed in other industrial States in coming legislative sessions, which indicates higher costs of insurance rates.

The New York State Department of Labor has sponsored a program of research in an attempt to develop a method of evaluation of partial disability from dust diseases, which so far has defied the medical profession. Mr. Waters believes the West Virginia statute covering partial disability provides the fairest method. It provides limited monetary benefits for partial disability, which releases the employer from any future claims for disability. In conclusion, he said that all States but Kentucky, Louisiana, Mississippi and Virginia will be in legislative session in 1949, and that labor will

(Continued on page 169)

A. Warsaw, Chicago, Ill., seems to be pushing a point here

Junius M. Strouss, Morgantown, W. Va., left, and Jesse T. Morie, Mauricetown, N. J., seemed in friendly mood before golf game

Junius M. Strouss, Morgantown, W. Va., points the way to golf enemy Jesse T. Morie, Mauricetown, N. J.

Henry Roeser, Jr., Millville, N. J., seems to disagree with T. F. Hatchs' scoring

Safety's Part in Production

Cement and Quarry Section meetings of National Safety Congress develop some practical suggestions for reducing accidents

By J. L. SEDLACK

CHICAGO was again host to the 36th National Safety Congress and Exposition held October 18-22, with the Cement and Quarry Section meetings taking place October 20-21 at the Stevens Hotel. Delegates from 26 States were present. F. J. Buffington, safety engineer, New York Trap Rock Corp., Cold Spring, N. Y., called the cement and quarry session to order at 2:00 p.m. Wednesday, introducing Erle L. Jackson, Director, Safety Services, Southeastern Pennsylvania Chapter, The American Red Cross, Philadelphia, Penn., who spoke on First Aid Organization.

Mr. Jackson said that with hazards inherent in the use of heavy equipment and in blasting, pre-practising of safety measures pays dividends. Personnel should be trained and given trial situations to cope with, especially where it is necessary to bring injured from the quarry face, or from the top of the crusher. Mr. Jackson particularly stressed the need for first-aid training for executives stating that the success of a safety program stems from the interest displayed by management.

First-Aid Requirements

In a good safety set-up, every company should have a main first aid dispensary, under supervision of the company doctor, with a full-time nurse, doctor or someone trained in first aid on duty. First aid substations should be established, usually one at the quarry, one for office and work buildings, and one for the mobile units. Breaking this down further, in the quarry the sub-station should be a special room. Each working gang should have one person trained in first aid and he should have on hand necessary first aid material. In the office and work buildings, there should be one person to a floor who is qualified to administer first aid. Each mobile unit should have one too.

Close cooperation between company doctor and safety engineer also was stressed. Sub-stations should be equipped only with contents approved by the doctor and these should be inspected regularly. A weekly checkup often uncovers unreported treatments. A standardized type of accident report form should be adopted, and good first aid work on the part of any employe should be recognized.

A report on Fleet Safety was given by Tom Sheets, Southwestern Portland Cement Co., Los Angeles, Calif., speaking for Max A. Koffman, secretary, who was unable to be present. Fleet safety depends on good equipment, good roads, proper use of equipment, good maintenance, and trained drivers. Regular safety procedures should be adopted including regular safety meetings.

Mr. Sheets placed emphasis on driver training using his company as an example. Any driver desiring employment must be experienced on heavy equipment, must pass a driver test, must attend the State Safety Center where he is tested and given a physical examination, must take student trips on company equipment, and must be instructed in accident prevention. Three safety leaders are chosen per month from among the drivers, and given a day tour of driver safety centers and traffic courts thus refreshing in their minds safety procedures so that they may be contacted by the other men on safety problems during that month.

At least four safety meetings are held per year, attended by officials, superintendents, repair foremen, etc., and consist of movies and "gripe" periods. Road checks and spot checks on trucks are made regularly and awards are presented to drivers for every year of safe operation.

Explosive Hazards

The concluding talk of the afternoon was made by MILO N. NICE, Hercules Powder Co., New York, N. Y., whose topic was "The Hazards of Explosives in Mines and Quarries." Since no explosive is perfectly safe, he emphasized that hazards must be recognized. Efficient blasting contributes to accident prevention, and for blasting to be efficient it is necessary to consider carefully the method of drilling, burden on holes and spacing, selection of proper explosives, calculation of necessary quantity needed, uniform distribution of explosives in drill holes, and method of firing of blast, the trend being toward short time delay firing, accomplished with electric blasting caps and timer switches. Split second delayed firing results in less vibration, reduces amount of back break, and, in almost every case, gives better breakage, thus better operation through increased tonnage, said Mr. Nice. A warning signal should be sounded before blasting, and *after* blasting is through. Explosives should be purchased from a reputable manufacturer, properly stored, and kept not longer than six months. Foremen safety meetings and weekly safety meetings of workers with foremen were urged. After a general discussion, a slide film was shown on "Jackhammer Safety."

F. J. Buffington, New York Trap Rock Corp., president, Cement and Quarry section

Election of Officers

The Thursday meeting opened at 2:00 p.m. with election of the following officers for 1948-49: general chairman, F. J. Buffington, New York Trap Rock Corp., Cold Springs, N. Y.; vice-chairman, Lea P. Warner, Jr., Warner Co., Philadelphia, Penn., secretary; Robert F. Boynton, National Lime Association, Washington, D. C. Also elected were the following: chairman Engineering Committee, L. D. Cowling, Louisville Cement Corp., Speed, Ind.; chairman Membership Committee, T. W. Jones, New Haven Trap Rock Co., New Haven, Conn.; chairman Program Committee, Ivan LeGore, Portland Cement Association, Chicago, Ill.; chairman Statistics Committee, Forrest T. Moyer, U. S. Bureau of Mines, Washington, D. C.; chairman Visual Aid Committee, F. L. Maus, Alpha Portland Cement Co., Easton, Penn.; and members at large V. P. Ahearn, National Sand and Gravel Association, Washington, D. C.; J. R. Boyd, National Crushed Stone Association, Washington, D. C.; T. M. Bushnell, Universal Atlas Cement Co., New York, N. Y.; F. R. Tittoe, the Kelley Island Lime & Transport Co., Cleveland, Ohio; A. J. R. Curtis, Portland Cement Association, Chicago, Ill.; O. M. Graves, General Crushed Stone Co., Easton, Penn.; Johan Norvig, Pennsylvania-Dixie Cement Co., Nazareth, Penn.; M. C. M. Pollard, National Gypsum Co., Buffalo, N. Y.; W. M. Powell, Medusa Portland Ce-

(Continued on page 174)

P. C. A. Comments on Research

By A. ALLEN BATES*

AT THE RISK of seeming momentarily facetious, which I most certainly do not intend to be, I would like to call your attention to the striking analogy between *democracy* and *portland cement*. Both are old in concept yet each is constantly appearing in strikingly new forms. The idea of democracy first shone as a tiny beacon at the eastern end of the Mediterranean Sea. Portland cement first stood out as a guiding light on the Eddystone rocks in the eastern Atlantic off the coast of England. Neither the democracy of ancient Athens nor the hydraulic cement of old John Smeaton was quite the same as its modern counterpart, yet each contained those essential ingredients which, upon wise use, provide the foundations of modern civilization.

Portland cement like democracy is never used pure and unmixed. The latter is employed to bind together societies which comprise both very intelligent and very ignorant people who mix their democracy with all of their good and bad prejudices, traditions, high ideals, low morals, loves, hates, narrow selfish interests, and broad altruistic aims, to produce great and little nations. Portland cement is used by both competent and incompetent people in mixtures with all of the good and many of the bad rocks, sediments, dusts and waters of the crushed, soiled and wrinkled layer of debris which we call the earth's crust, to form great dams, harbors, cities and highway systems.

Disruptive Forces and Concrete

As if not content with the natural ravages of time, greed, economic cycles, hot academic fervor and cold general ignorance, man is continually subjecting his democracy to newly invented and more powerful agencies of destruction such as communism, thought control, fascism, propaganda, dictatorship and the crushing, grinding, ever-increasing march of vast, clanking, mechanized armies. Likewise, to the natural, inevitable and gnawing cycles of heat and cold, freezing and thawing, wetting and drying, which erode his structures of concrete, man further adds corrosive salts and solutions, abrasive sands and cinders and the terrific attack of massive trucks, planes, tractors and other forms of mechanized transport which seems to increase annually beyond all previously reasonable concepts of size and mass.

The wonder of it is that portland cement and democracy continue to exist at all. But they do. They somehow thrive and peoples of the world want more of both. There lies the ultimate tribute to and proof of the immense utility and fundamental indispensibility of both.

The portland cement industry neither seeks nor needs any defense. For decades it has been carrying on through the medium of its own individual company laboratories and through those of the Portland Cement Association a costly and far-reaching program of research and development. Such an effort is proof that the industry is progressive, courageously far-sighted and is also frankly cognizant of the possibility and need of improvement in portland cement and concrete.

40 Years of Research

In reviewing what actually has been accomplished by the industry in the last 40 years of research, I will only point out that the necessarily astute business and technical leaders of the cement industry would not have continued to spend millions of dollars on research and development had there not resulted a commensurate flow of useful knowledge and accomplishment. The great modern research and development laboratories now being built by the Portland Cement Association near Chicago are a striking and tangible reaffirmation of the courage, vision and high purpose of the cement industry. They are also a restatement of the conviction and determination held by the industry that portland cement can be, must be and shall be still further improved and made even more useful to all men.

Returning once more to my original analogy, it is pertinent to note that both democracy and portland cement concrete owe much of their greatness to their inherent timelessness and stability. Neither offers a field for the gadget-minded. The constitution and best uses of concrete like the constitutions and applications of democracy evolve slowly and require the tests of time under the observation of experienced and competent men.

And yet both democracy and concrete are superlatively plastic and endlessly versatile. Therefore their uses are being constantly multiplied and extended, though not always competently or wisely. Each suffers its setbacks and failures, and enjoys its triumphs. Democracies may lead the way in freedom of individual expression, in universal education, in social security, in women's rights, and yet democracy may fail in a Germany or in a Czecho-slovakia, for reasons known or unknown. Nevertheless such failures do not lead those who have truly known democracy to question its fundamental value or its historic progress—and meanwhile teeming India triumphantly chooses to become an autonomous democracy.

So, too, the portland cement industry makes its great advances: water-cement ratio, air entrainment, high early strength, successful retardation and reaction rate control, sulphate resistance, low heat cements, a continually improved quality control in the mill and an increasingly profound comprehension of the fundamental chemistry and physics of cements and concretes. Yet here and there a road has scaled and cracked or a bridge has weathered badly, become unsightly or expanded enough to give concern, all for reasons known, unknown or possibly not yet fully discovered. Nevertheless, greater dams and irrigation systems, more magnificent superhighways, better factories, apartments and office buildings, cleaner barns and farm yards, more livable homes, all built of portland cement concrete, continue to spring up across the land to prove the basically sound and infinitely useful progress of this youngest but greatest of modern engineering materials.

Diversity of Specifications

In conclusion may I point out a particular factor which has had much bearing upon the character of present-day portland cements. Because concrete is so widely used in so many final forms, because it is so vital to all advanced societies, because it is so complex in its physico-chemical structure, and because the structures made of it are expected to endure indefinitely, many organizations and agencies, both public and private, have felt it necessary or desirable to exert an influence on the specifications and tests which govern cement and concrete. Few engineering materials have been subjected to more attention or pressure in this regard. As a result, specifications and tests for present-day portland cements reflect in large measure the diverse and frequently conflicting opinions of many users rather than of the makers. A disturbing percentage of these tests and specifications are indirect and remote from any final quality or

(Continued on page 174)

● Dr. Bates, in this presentation, presents the views of the Portland Cement Association, in reply to a letter from the editors which was identical to that sent to individual cement manufacturers. We requested comments on the accomplishments and aims of research and sought the cement industry's point of view particularly. Ideas and comments from users of cement and concrete are summarized elsewhere in this issue.

—The Editor

*Vice-president for research and development, Portland Cement Association, Chicago, Ill.

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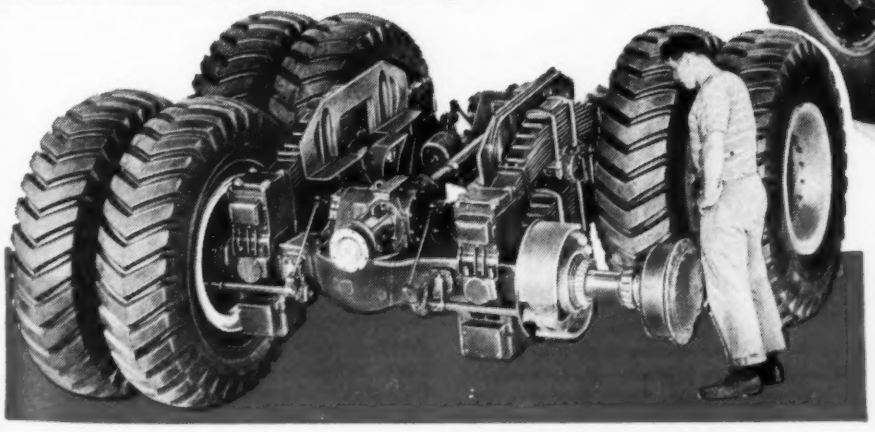

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Industrial Minerals Conference

Stress Commercial Aspects of Non-metallic Minerals at A.I.M.E. Meeting at St. Louis, Mo.

LIMESTONE, dolomite, lime, mineral wool, silica, fluorspar, barite, and the blasting and beneficiation of non-metallic minerals were discussed at the Fall meeting of the Industrial Minerals Division, American Institute of Mining and Metallurgical Engineers, at St. Louis, Mo., October 13-16. The program was unusually generous in the number of papers presented covering commercial aspects of production, with much emphasis on occurrence of non-metallic minerals and their exploitation in the St. Louis area and Missouri. It concluded with a field trip to Crystal City, Bonne Terre and Potosi where dolomite, silica and barite operations were inspected, and an alternate trip at the special invitation of Horace Krause, president of Columbia Quarry Co. to the company's limestone plants at Columbia, Valmeyer and Prairie du Rocher, Ill.

Barite

Garrett A. Muilenburg Missouri Geological Survey, Rollo, Mo., in a lengthy paper "Barite Mining and Production in Missouri," discussed the location, geology and mode of occurrence of barite deposits in Missouri; mining, milling and recovery methods; uses and production. Mining of barite began about 100 years ago in Washington county, 50 miles southeast of St. Louis and in central Missouri. The Washington county area for many years has been the leading producer in the nation and barite has been produced in at least 12 central Missouri counties.

Practically all the workable deposits in the Washington county area lie in residual clay derived by weathering from the Potosi and Eminence formations. Thickness of the residual mantel averages between 10 and 15 ft., with the barite occurring irregularly distributed throughout the mass of red clay along with chert, quartz druse and limonite. The barite varies from minute particles and chips to large nodules and lumps and, in re-working deposits a second and third time, smaller and smaller sizes are being recovered.

Barite Operations Mechanized

Until quite recently most Missouri barite was produced by hand methods but the industry is now almost 100 percent mechanized. All mining is in open pits and much good ore is often left in the hollows between pinnacles of underlaying bed rock. Excavation is done by small diesel or gasoline engine-powered shovels or draglines and haulage is by trucks to the washing plant. In central Missouri, drilling and blasting is necessary in a rock breccia. In deep circle deposits, ore is hoisted in a clamshell bucket operated from a derrick. Milling consists of washing to remove clay, screening and breaking to remove coarse waste rock and jigging for separation from waste material. In a typical plant, the ore is passed over a stationary or rotating grizzly. The grizzly feeds to twin steel logs and the discharge goes to a breaker screen, or a jaw crusher, and the undersize becomes feed to plunger or diaphragm type jigs. In some plants fines are recovered by tabling.

The minimum of recoverable barite for profitable operation is about 150 lb. per cu. yd. of earth, or an acre foot of land would yield 200 to 250 tons of concentrates. Mechanization of the industry has made it possible to operate with profit in areas where hand miners earlier had left only fines scattered through the waste dumps. Froth flotation is apparently feasible but has not yet been introduced in Missouri operations. The retreatment of mud from old settling ponds is under consideration and apparently is economical. Reserves in Washington and adjoining counties total an estimated 15,000,000 tons of barite.

Thomas L. Kesler, Thompson-Weinman and Co., in a paper discussing the occurrence and exploration of barite deposits at Cartersville, Ga., said that that area produced 21 percent of the national tonnage from 1880-1947, within an area four and one-half by two miles which has 35 mines. The deposits are residual, unusually deep and difficult to test. A method of core drilling whereby drillings from an encased 4-in. hole enter a spill box for screening and then measurement to determine anticipated recovery from log washers was described.

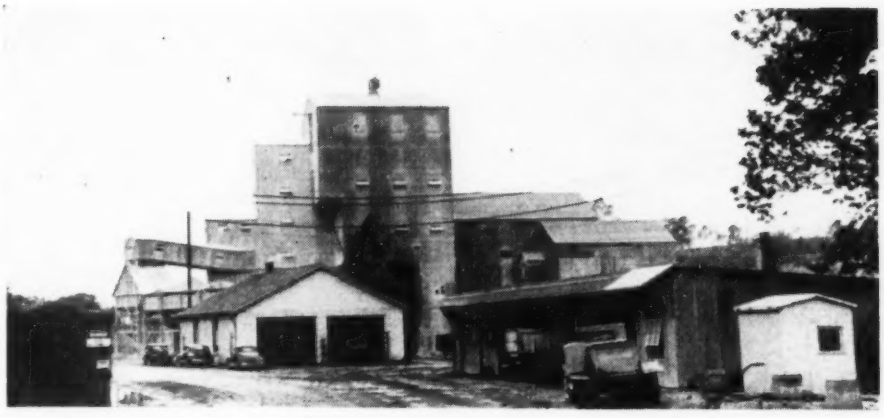
Jointing and Blasting

A. R. Glockzin, Ohio Geological Survey, presented a preliminary report on a study of relationships of jointing to quarry shot patterns in Western Ohio limestones which possibly might prove beneficial to commercial quarry operators. In this research project, 15,000 observations have been made thus far to determine the directions of fracture, in quarries within one and one-half counties near Columbus, Ohio. An average of three bedding joints has been found in quarries so far studied. According to Mr. Glockzin, operators of quarries in Ohio do not know the existing fracture patterns and therefore their relation to shot patterns. A common mistake noted was to develop faces paralleling property lines with disregard of fractures that might be utilized to advantage in blasting. Purpose of the research is educational and the plan is to prepare a paper for the guidance of quarry operators with suggestions as to how to improve blasting technique, and to develop information to guide in selecting dam sites, in the location of oil fields, etc.

Limestone-Dolomite

Ralph W. Smith, director of research, Ste. Genevieve Lime Co., discussed the mining and processing of limestone and dolomite in the St. Louis area. He briefly and very generally described operations of Valley Dolomite Corp., Bonne Terre, Mo., which is the only important producer of dolomite in Missouri. A minus 10-mesh agricultural limestone product is produced and 7/16-in. to 10-mesh stone is burned in rotary kilns to produce refractories for the basic steel industry. Average analysis of the stone is 50-55 percent $CaCO_3$ and

Horace Krause, right background, discussing the geology of the Krause limestone quarry to group on A.I.M.E. field trip. Almost hidden, left, is Brian H. Mason, associate professor of Mineralogy, Indiana University; and center, smoking cigarette, is Charles F. Deiss, State Geologist at Indiana University



Recently rebuilt after a fire, this plant of Columbia Quarry Co. was visited on the field trip

40-45 percent $MgCO_3$ with a maximum of 1-2 percent SiO_2.

The famous high calcium oolitic limestone of Ste. Genevieve originally was burned into lime in pot kilns in 1890. In the 1920's underground mining was adopted and four such operations were in production in 1937. Mississippi Lime Co. took over all operations by 1947 and is operating three vertical kiln plants with 35 kilns ranging in output from 16 to 80 tons of lime per day. Six rotary kilns are operated. Of the vertical kiln plants, two have automatic gas producers each serving four or five kilns. Some have side and center burners.

Mining has worked out well in the area according to Mr. Smith. The pattern is typical room-and-pillar and, in the Mississippi mine which is the largest, balanced skips are used to elevate the stone out of the mine. The drilling pattern was described and the method of mine ventilation. Trucks in the mine deliver 10 ton loads to a crusher, the product is elevated, and 5- to 10-in. stone is sized over a grizzly for vertical kiln feed. Four sizes of stone, with a top size of 2½ in., are screened for rotary kiln feed and minus ½-in. stone is processed into glass stone. Rotary kilns range in size from 8 ft. to 11 ft. 6 in. diameter and up to 300 ft. in length, are gas-fired and have coal mills for standby service. Mr. Smith concluded by listing some of the many uses for lime.

Feldspar

L. P. Warriner and B. C. Burgess, president and vice-president, respectively, of Appalachian Minerals Co., were co-authors of a paper describing the pegmatites of Jasper county, Ga. Jasper county is 35 miles north of Macon and 60 miles southeast of Atlanta. Mr. Burgess first recognized the presence of economically important pegmatites in the hornblende gneiss in the southern half of the county in 1943. A feldspar grinding plant was built in late 1947 after a program of surface prospecting and drilling. The pegmatites vary from graphic granites to well-segregated aggregates of quartz, feldspar and mica. Economic products are feldspar and mica. The glass industry of the South is the main outlet for ground feldspar. Future plans provide for installation of a fine grinding unit to produce products for the ceramics industries.

Mineral Wool

S. M. Mulloy, U. S. Bureau of Mines, Rollo, Mo., described experiments and preliminary results in a cooperative research program with the Celotex Corp., to determine methods of control for mineral wool fiber size. Calibrated orifices are used in the study and accurate methods for measuring viscosity have been developed for experiments under simulated plant conditions. Steam is the fiberizing medium in determinations of the relationship of fiber size to viscosity. Fusions of various viscosities have been made and, in some of the experiments, impact distance has been reduced below normal, and the steam pressure reduced simultaneously to hold the normal impact velocity in order to determine effects on fiber size. Steam impact velocity and viscosity have proven to be the most important governing factors in fiber size. A given size of fiber can be held by changing the viscosity and impact velocity. Factors influencing fiber length, and also fiber size distribution also are to be studied.

Progress in Beneficiation

G. W. Jarman, Jr., Separations Engineering Corp., New York, N. Y., in a paper "Progress of Methods of Beneficiation," reviewed developments in methods of separation and concentration other than by flotation, including magnetic separation, electrostatic separation and separation by differences in specific gravity by various types of machines. Air tabling, cyclone aspiration and electronic color sorting were dry methods discussed and, for wet separation, Dutch cyclones, heavy media, spiral concentrators and suspended wet-type magnetic separators. A recent permanent magnet development to minimize the enchainment of non-magnetic particles by those which are highly magnetic and to increase the arc of the field of force has six flat magnets which make up a hexagonal pulley around which a belt to an idler pulley goes loosely forming 12 north-south air gaps which are rotated. The material is poured vertically past these changing fields and only the iron-bearing material is attracted over from the falling stream, to land on the belt which carries them back underneath until past the fields.

Electrostatic separation has made greatest progress of the dry methods in recent years in Mr. Jarman's opinion. The separation of materials has become much sharper and the cost of construction has been markedly reduced. Many of these separators are now in use, without acid preconditioning, in the beneficiation of beach sands. It has always been considered necessary for the material to be separated to be dry and preferably warm, but Mr. Jarman has seen very damp materials separated electrostatically. He believes that the possibilities of this method of separation have hardly yet been realized. One limitation is that particles must be in the size range between 200-mesh and 6- or 8-mesh for effective separation.

Electronic color sorting could be used in the mineral industry provided particles are large enough to be handled. Each particle must be mechanically lifted and put in front of the "seeing eye" so must be the size of a pea or bean. The machine is very sensitive and can separate particles of two different shades between which the human eye can hardly differentiate. The limiting factor is a maximum of 3500 objects per pound.

The Sutton, Steele and Steele Avalanche separator, a new machine of far greater capacity than the air table was described. Capacity is 50,000 lb. of material per hour. The requirements are that the feed contain a small amount of relatively heavy material against large amounts of lighter material. The separator, much like an air table, is fed from above in the middle and air is forced upwardly through a porous surface from a fan. Heavy particles sink and on contacting the deck acquire its motion and "walk" uphill, while light particles flow in a stream downward off the other end. Particles as large as one inch can be separated. The air table, according to Mr. Jarman, can separate any materials with a 10 percent differential in specific gravity.

The Controlaire separator, by Sutton, Steele and Steele, for dry separation of relatively fine particles by differences in weight per cu. ft., was described. One of these units is being used in California in the separation of mica from quartz. The Humphrey's spiral concentrator has given excellent results in beach sand separations where the feed consists of silica, magnetite, ilmenite, rutile and zircon with garnet, kyanite and other medium-weight minerals. One great advantage is the small area of plant required. Dutch States Mines cyclone separators using heavy media effec-

(Continued on page 178)

Mining Congress Convention

Dredging problems, stripping operations, drilling among topics discussed

THE CONVENTION of the American Mining Congress held recently in San Francisco paralleled similar conventions devoted to the rock industries. Mining, whether it is open pit or underground, is still mining and possibly 90 percent of it revolves around economical methods of handling products of the earth be they metallic ores or sand and gravel. The parallel becomes obvious when the excellent exhibits that the equipment manufacturer's had at the meeting were compared with exhibits in the crushed stone and similar industries.

One paper of interest was "Experience in Use of Tungsten Carbide Insert Bits," by Blain Burwell, President, Minerals Engineering Co., Grand Junction, Colo. Mr. Burwell brought out that the best results have been with bits 2 in. or less in diameter, used with relatively light air drills. Better alignment of the drill was also important, he said. One mine operator said that of all insert bits going to his mine, 27 percent were lost, 21 percent were "skirt" failures, and 10 percent were lost from worn threads. Another speaker said that the use of smaller bits was a trend, and that alloy steel drill rods gave faster drilling, and that "throw away bits" were being tried. This is a type of bit that when worn is discarded.

H. A. Sawin, Yuba Consolidated Gold Fields discussed some of the dredging problems in California. These large scale operations are quite unique in that most of the dredges in the West were built by the Yuba Manufacturing Co. and operated by its subsidiary company. Thus being manufacturers of equipment and, at the same time its operators, they have developed ladder-type dredges of great capacity. These operations have been kept producing profitably on ground that contains only a few pennies per ton in gold.

The subject of "Automatic Controls in Milling" was discussed by I. Milton LeBaron, International Minerals and Chemical Corporation. "Non-Metallic Minerals of the West" was the subject of a paper by Henry Mulryan, vice-president and general manager of the Sierra Talc and Clay Co. of Los Angeles. He gave a picture of the rock products industries in the West, pointing out that the old timers were portland cement, sand and gravel, limestone, gypsum, barite, feldspar, talc, etc. The new-comers were vermiculite, pumice, diatomite, pyrophyllite, and many other lesser known nonmetallic minerals.

Earl S. Mollard, manager of mines, Butler Bros., Cooley, Minn., described a dragline and conveyor stripping operation at their Agnew mine. Here they had 80 to 170 ft. of glacial drift that was mostly gravel and which contained boulders up to 10 ft. in diameter.

John K. Gustafson, director, division of raw materials, U. S. Atomic Energy Commission, gave a talk inviting the mining industry to learn some of the basic requirements relating to uranium ores. As some granites, particularly pegmatites, often contain radioactive material it is very possible that this type of mineral could be present in some deposits of the rock products industry.

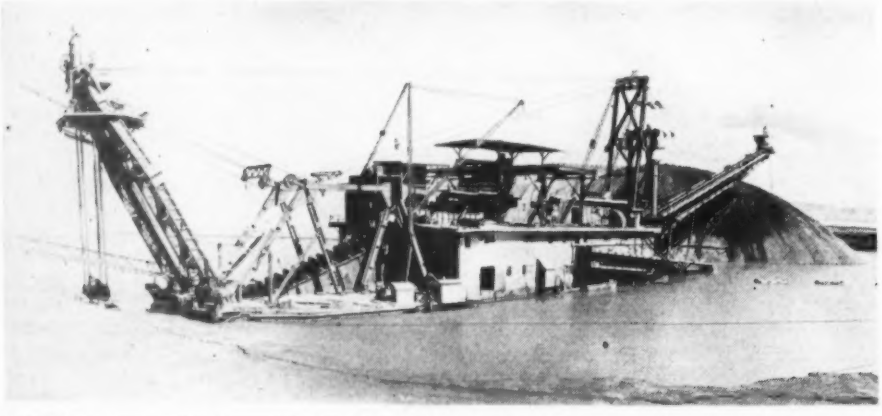
Last two days of the week were devoted to field trips to the lode and placer mining section of California. The dredge visited was built by the Yuba Manufacturing Co. and operated by the Yuba Consolidated Gold Fields.

This dredge has a digging ladder of 122 buckets, each holding 18 cu. ft. and they discharge at the rate of 21 per minute. It digs 112 ft. below water level. The buckets were made by the Taylor-Wharton Iron and Steel Co. (TISCO) and have an easily replaceable Amsco manganese steel lip that is bolted in place with only two bolts. This is a patented feature and replaces the older type of lip that was riveted in place with a series of rivets. The pins connecting the buckets are about 6 in. in diameter and are of alloy steel and are pressed into place and held there by friction. When they become worn they are easily replaced.

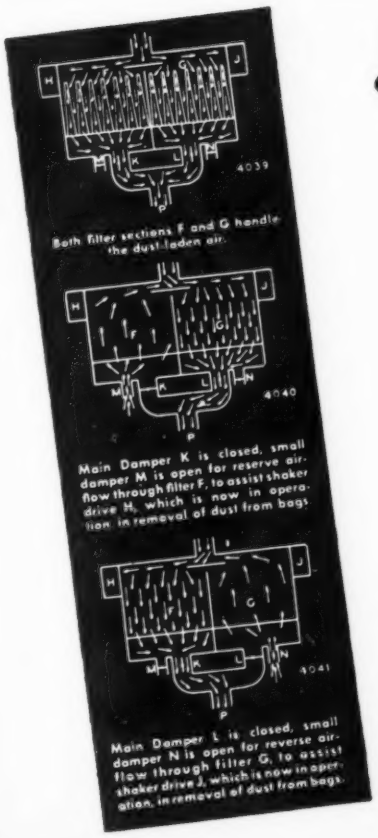
Louis Ware, president, International Minerals and Chemicals Corp., center, talking to Charles Deaver, resident superintendent, Yuba Consolidated Gold Fields, on board one of the large dredges near Marysville. Left in group is S. P. Wimpfen, editor, Mining Congress Journal (back to camera), talking to Tom Ware, son of Louis Ware

The boat has an over-all length of 465 ft. and has a 250-ft. stacker using a 48-in. belt that rides S-A. 8-in. diameter carrier rolls. The belt is often called on to handle boulders up to 18-in. diameter, and special provisions are provided to prevent "roll back" of these donikers. The hull is 11-ft. deep and it requires 8 to 9 ft. of water to float the dredge. The main part of the dredge is 233-ft. long and 70-ft. wide. About two-thirds of this space is required for the primary grizzly, rotary scrubber and screen, drive mechanism, drum hoists, etc., with the remaining area open. Everything relating to the dredging and processing is carried on the hull and the only normal shore connections are the mooring lines and the electric cables. High banks above water line are cut down by a hydraulic monitor mounted on the deck. The dredge requires four men to operate it per shift with two additional men on the day shift, and the dredge master. The digging ladder uses a 500-hp. drive unit.

The dredge visited is one of the older ones owned by the company as the Yuba operators have several in the district. One of the later dredges has two stacker belts that can be swung at right angles to the hull. These dredges are used to recover precious metals as well as to open up old river channels, etc., for better drainage. The visitors were all very impressed with the efficiency and low operating cost features of these dredges.



One of the large Yuba Manufacturing Co. dredges that is being operated near Marysville, Calif., by Yuba Consolidated Gold Fields, which was visited by a group attending the Mining Congress meet at San Francisco. These dredges handle large tonnages at remarkably low cost per ton



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Research in Concrete

(Continued from page 133)

in use today. In more recent years, however, it has become increasingly evident that the whole answer to the question, 'Is concrete permanent?', is not to be found in various theories of concrete mixture design, water-cement ratios and the proper usage of cements.

"What is needed today? It is apparent from the foregoing discussion that research along the following lines is needed:

"1. Research to provide greater knowledge of the problems dealing with the behavior of the mineral constituents of the fine and coarse aggregates as they affect the hydrating properties of the cement.

"2. Research to determine the effect of the above action in setting up of stress-strain relationships in the concrete masses.

"3. Research to determine the effect of fine and coarse aggregates in very lean concrete mixes as related to consistency, optimum contents of different size ranges of coarse aggregate in the size ranges now specified.

"4. Research to determine if there is an optimum content of so-classified 'reactive minerals' that can be used in mass concrete without resulting in high maintenance cost.

"5. Research to further study the reactions of so-classified reactive minerals so that test results under certain specified conditions can be obtained which will truly tell what may be expected to be their action in concrete.

"6. Research on the thermal properties of fine and coarse aggregate and the combination thereof as related to durability of concrete."

Another government laboratory engineer suggested that research is needed, as follows:

"The direction of future research will be determined by the needs of the engineering profession. Two opposing forces must be reconciled: the need for extending the permanence of concrete and the requirement that economically available materials be utilized. The challenge is to develop suitable criteria for the selection of materials and to modify the physical and chemical properties so that the demands of economy and permanence shall be met.

"Investigation should be made of the nature of the forces causing concrete failure. The forces of ice formation and volumetric instability should be appraised. Incompatibility of components caused by thermal effects of whatever origin, size and shape of aggregate, and chemical phenomina should be measured.

"Attempts should be made to control the size and distribution of air voids. Gradation applied to air entrainment should be as feasible as gradation of aggregate and should be as rewarding. In this connection the study of the thermodynamics of the surface forces of plastic pastes is indicated.

"For massive structures in which the heat evolution of the cement becomes important, means for reducing the cement factor without loss of plasticity or impermeability should be studied. It is possible that the replacement of water by equivalent amounts of air may be effective.

"Another facet of future research should be the study of the effect of time on the reversability of the cement-paste volume change and the fatigue and hysteresis functions.

"The application of radio-active tracer techniques to mixing studies and osmotic phenomena holds promise."

Highway Engineers Comment

An expert in the field of highways commented as follows:

"To me, the greatest lack in the technology of the material is the fact that we cannot yet measure the characteristics of samples of the ingredients for a given job and from the measurements determine forthwith the proportions that should be assembled to produce the required strength or degrees of durability. We have gone a long way in that direction, but I hope continued research will carry us further.

"Recently we inquired of the State highway departments of the United States their opinions concerning needed research. A list of their perplexities relating to concrete provides an interesting commentary on the state of the art. These include: durability, curing, air-entrainment, admixtures, chemical composition, workability, pumping joints in pavements, resurfacing of pavements, alkali action, volume change, warping of slabs, bond stress, elastic properties, prestressing, design and spacing of joints in pavements, dowels corrosion, joint and crack filler.

"That many of these research needs are years old does not necessarily imply lack of study or lack of progress. Rather the list directs attention to the facts that changing conditions and acquisition of new knowledge continually put old problems in new light. There may be some implication, however, that dissemination of the great store of knowledge pertaining to concrete, in the hands of the research technologists has not gone far enough."

Highway engineers' observations and opinions are as follows:

"What is sometimes termed 'poor concrete' becomes a very complex problem. Thorough and very detailed information must be obtained regarding all materials, workmanship, handling, curing, finishing, etc., before the item which may be the cause is located. In most cases this complete information is not available. A violation of good practice in any one or more of these items may result in poor concrete. Concrete of good quality requires an organization with personnel trained and experienced in all phases of the design and control."

* * *

"There is, however, concrete still in service which was produced 25 years or more ago under what are now considered the crude and antiquated methods of the time, with the proportions being measured by means of a shovel or a wheelbarrow, and with the use of enough water to produce a mixture somewhat on the fluid side, and perhaps at times even being a little light on the 1 part of the 1:2:4 mix, and which at present still appears to be in rather sound condition. On the other hand, there is also concrete of lesser age and service which was produced with the benefit of the more recent developments in technique and which yields evidence of disintegration.

"The wide range of serviceability between these extremes, even though constituent materials of quite comparable characteristics were used, would suggest that some research might be extended toward a correlation of condition to service exposure. There is a large volume of concrete now in service which has attained sufficient age so that detrimental exposures have shown their influence.

"It is believed that with a background as could be provided by such a study, the more technical and refined study and research of the material itself could then be more objectively directed toward the solution of the problems which appear to be inherent to the material."

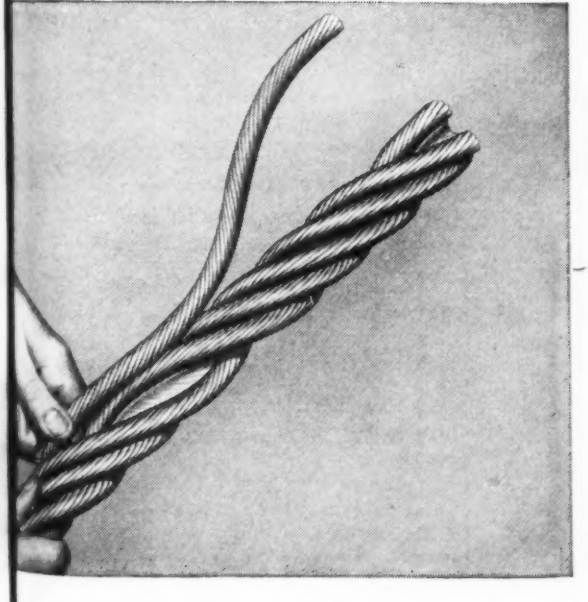
* * *

"Considering the present day situation, as compared to that of the early days, the research conducted during the years has paid great dividends, and it is a safe prediction that future research will be greatly profitable. It is also safe to predict, in view of the benefits derived, that research will continue along all phases of concrete production. However, the greatest need should be first served. It is my opinion that intensified research should be directed toward the study of air-entrained concrete. It is true that ample evidence exists of the beneficient effect of air-entrainment in producing durability. Beyond this, the information available must be considered fragmentary. Thorough research, somewhat of the nature of that conducted by Duff Abrams in the early days, is an immediate need."

* * *

"The most recent development so far as our State is concerned, has been the reduction in the maximum size permitted for coarse aggregate for use in concrete. For many years, permission was granted for the producer to use stone of a 2-in. maximum size in concrete pavements and a 1½-in. maximum size in structures. Through studies of freezing and thawing tests we learned that this maximum size was apparently too large for the most efficient use of most of the stone which occur in this State. We there-

(Continued on page 146)



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fore now require that all stone used in concrete work be of a maximum size of 1 in.

"We are unfortunate enough to have only marginal stone deposits, in a general sense of the word, available for highway construction. We, therefore, must make the most efficient use of what we have to produce the most durable concrete that is possible. Reducing the maximum size of stone from 2 in. down to 1 in. has resulted in an improved quality of concrete both from a density standpoint and a durability standpoint.

"Insofar as the needs for further research on the use of coarse aggregate in concrete are concerned, it is doubtful if the ultimate has been achieved in the present freezing and thawing test which we use. We are, therefore, expecting to remain in constant alertness by examining our concrete pavements from time to time to detect weaknesses as they manifest themselves.

"There is also a general feeling particularly evidenced by the present Corps of Engineers' specifications in which it is believed that the fine aggregate and coarse aggregate should be of the same type and preferably from the same source in order to achieve the greatest amount of durability in concrete. No doubt that this need for compatibility of the fine and coarse aggregate used in concrete could stand careful study and further research. There is also a likelihood that the reaction of some cements with certain coarse aggregates is effective in producing an inferior or superior grade of concrete. This line of study could also be further developed and investigated."

* * *

"The present indications are that a major portion of the aggregates in this area are definitely reactive with cements containing sodium and potassium oxides above .5 of 1 percent. The aggregates in most cases are directly or indirectly the products of nature. We cannot change nature or discard our major sources of aggregates.

"We believe that cement, the product of man's handiwork, can be manufactured to serve the intended purpose satisfactorily and that the industry should be willing to give us a satisfactory product."

* * *

"It appears that research in concrete should be directed toward obtaining greater durability, not to increase the years of service of the many instances of good concrete but to avoid the too frequent instances of concrete of short service. This undoubtedly is a difficult problem for there may be a variety of causes and they may be very complex. It involves study of each of the components of concrete as well as their combination. The discovery and advance of knowledge concerning alkali-aggregate reaction illustrates a field in which research has contributed greatly toward producing more durable concrete or avoiding non-durable concrete. But alkali-aggregate reaction does not account for all non-durable concrete. Other causes should be searched out and identified."

* * *

"Paralleling increased knowledge of how to make portland cement has been the increased demand on the mills for production and economy. Specifications have called for higher strengths at early ages for most portland cement concrete and it has reached the point now where durability is considered of equal if not greater importance than strength since strength is so readily attained whereas durability is still an uncertain quantity. Within the last decade nine types of portland cement have been standardized or proposed for standardization; four of them are air-entraining types. Closer controls are specified for most of the types than were used previously to assure soundness and durability and in our State we feel that Type II cement is the most desirable for our purposes. Recently there seems to have been an increased resistance of the manufacturers to the production of Type II, probably because of the much closer control required of chemical composition and the frequent necessity of importing certain raw materials such as iron ore not required for Types I and III. The current trend towards making a 10c or 15c difference in price between Types I and II may overcome this resistance and it will then be a question for the user to decide whether the Type II cements are preferable to the available Type I cements, since many Type I cements are only slightly outside of the requirements for Type II cement.

"Air-entraining cements still are gaining ground, or perhaps it should be said that air-entraining concrete is becoming more widely used every year because of its better workability and especially for its greater durability or resistance to destructive influences, even alkali reactivity. In our State we have experienced an almost negligible amount of alkali reaction between cement and aggregates and except for the bleeding of some concrete mixtures due to the total absence of fine silt and clay, the workability factor has given us no appreciable trouble, therefore, we have not fallen in line with other States which have found air-entrained concrete to be the answer to most of their concrete problems. Another factor has caused us to hesitate.

"Up to 1933 we did not place any construction joints, either expansion, or contraction, in pavements except we used the plain butt joint at the end of each day's operation, or where the mixer was down for more than 30 minutes. Since 1933 the Public Roads Administration has required joints at certain intervals when pavements were constructed using federal-aid funds. Under conditions existing in our State, and with the experience we have had in constructing pavement without joints we did not feel justified in following the requirements of the Public Roads Administration in placing contraction and expansion joints. We attempted to get them to agree to permitting us to eliminate the majority of these joints. We finally got them to eliminate the expansion joint, but they still require the contraction joint at 30-ft. intervals. It is our opinion that concrete pavement built since 1933, with the expansion and contraction joints has not proven as satisfactory as that built prior to that time.

"A crack survey was made sometime ago and showed that every transverse crack in the pavements that had been built from 10 to 20 years, averaged about 70 ft. apart. We have had much less pumping, faulting, and rough riding on pavements constructed without joints than we have on those where the joints were used."

* * *

"It can be said that the research and field studies during these years have contributed much to the improvement of concrete. Concrete mixes can be designed where strength can be reasonably accurately predicted. But there still remains much to be done. There is at present no generally accepted test that will accurately predict the performance of aggregates, combinations of aggregates or combinations of cement and aggregates. We are at present engaged in a study of many miles of pavements in an effort to determine the unsatisfactory performance of certain aggregates. Why, for example, should a pavement show consistently low joints to the extent that the pavement is decidedly uncomfortable to ride, in an area where adjacent pavements constructed of other aggregates show high joints because of moisture effect on the underlying subgrade?

"Where adequate construction records exist studies of old pavements would be invaluable.

"In view of the steadily diminishing supply of aggregates of a quality presently specified it appears that lower quality aggregates must be, in the not too distant future, seriously considered for use if concrete pavement construction is to be continued. What percentage of deleterious materials such as shale, cherts, and similar materials can be tolerated in a mixture? How soft can the aggregate particles be before the aggregate cannot be used? Perhaps in this approach to the problem, consideration must be given to the use of a bituminous wearing course on an admittedly poorer pavement than built under usual standards. But certainly, consideration must be given to the use of relatively inferior aggregates and the effect of the use of such aggregates on the pavement design."

* * *

"Engineers are constantly seeking

(Continued on page 152)

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Research in Concrete

(Continued from page 146)

to improve the materials of construction and advance techniques so as to produce better and more durable structures; therefore, research must be continued. Every project constructed in which concrete is used should be utilized as a research project. Most of the research work which has been and is being conducted is in the nature of the testing of specimens under various conditions which are supposed to represent the various concrete mixtures and simulate the conditions of use. However, the results obtained under such conditions do not always produce answers relative to results that are secured under practical application of the concrete. In other words, service records of the results secured with the use of concrete are just as necessary as the research carried out upon samples of concrete fabricated for this purpose.

"Continued research programs are desirable to study (1) the reduction of the growth or expansion of concrete, whether it be due to either normal thermal expansion or to a possible reaction between the cement and the aggregates that are used, (2) the accumulation of information as to materials used, methods of fabrication and service records of concrete pavements and structures for the purpose of studying the reasons for the results secured under actual use, and (3) the continuation of research to develop positive laboratory tests that will develop information to determine with accuracy the results that can be expected to be secured with the various types of materials and methods of fabrication, and (4) the development of vehicular pavement concrete which is more resilient."

* * *

"It seems to the writer that there is a possibility of further spread on the water incorporated into the concrete mix having in mind the possibility of a wetting agent in the water as, for instance, the quadra lateral ammonia compounds now being used for household purposes. This last remark is merely a thought; however, when an opportunity develops, we would like to make a small scale study of this phase of concrete design."

"All of these things are on the favorable side of the ledger and add up to the fact that I am satisfied with the progress in research and its accomplishments; satisfied to the extent that I doubt whether we could start from the same point and with the same facilities and requirements accomplish any more in the next 40 years than was accomplished in the past forty. Even so, I am dissatisfied because it is obvious that we know comparatively little about concrete in its relation to service requirements. We have just discovered that proportionality between stress and strain does not hold for both principal components in reinforced concrete; we have yet to devise a valid basis for design of concrete pavements considering inherent stresses as well as those induced by external factors such as loads, temperature, moisture, etc.; we have no positive explanation of the fact that some concrete in structures having severe exposure (bridges, stadiums, etc.) is very durable whereas the same concrete laid on the ground as a relatively thin slab is not durable against exposure exclusive of traffic loads; we do not know why concrete of seemingly identical composition placed in two separate locations gives both poor and excellent performance under similar service conditions. These and many, many others are things that we do not know about concrete, and some are basic requirements for the future if we continue to progress.

"Concrete by nature defies precision in evaluation, design and application because of the several components and diversified sources of those components, and more so because of the various operations and hands through which it passes from the time of processing components individually to the finishing of the combined material on the job. Nevertheless, we should be able to at least evaluate each component individually from the standpoint of desirability in the resultant mix and the ability of that mix to withstand all conditions to which it will be subjected as hardened concrete. This we have not been able to do successfully, particularly with regard to aggregates. Several investigators have shown that present standard tests for aggregates are poor indicators of the value of those aggregates in producing sound and durable concrete, yet we have failed to develop a new and valid basis for aggregate specifications and tests."

A cement company research chemist commented as follows:

"There are those who still wonder whether any real advance has been made because of a number of present-day failures, whereas many of the old structures built prior to 1920 with the haphazard cement (as judged by modern standards) then available, still stand, and give good service. The thought occurs that perhaps even better results might have been obtained in these instances with today's cements, manufactured under very much better controlled conditions, were it possible to get the contractor to accept a product with the slow-hardening characteristics of the older variety. In instances where modern concretes lack the proper degree of durability, it is not necessarily due to science being remiss in showing us the way, but rather that we knowingly or unwittingly disregard its edicts. Where outstanding successes have been noted in old structures, this may have been more a matter of good luck than good management.

"We require more information concerning proper methods of heat-treating our clinker. Chemical composition alone and completeness of reactions do not assure the best types of cements. The crystalline and glassy phases of the alumina compound have a tremendous effect on the characteristics of the concretes in which these cements are used. Specially designed heavy machinery to enable us to duplicate our laboratory results on a commercial scale is essentially needed.

"The use of 15 to 20 percent of some type of pulverized pozzolana material appears to be a fairly satisfactory way of offsetting the evil effects of only 1 percent or less of combined cement alkalies although it seems to be a very inefficient way of doing this. Perhaps research may show that additives, especially of an organic nature, in small quantities will do the job. We must also place in the hands of the consumer a simple and reliable test to determine whether or not the aggregates he proposes to use require a low alkali cement, possibly of the pozzolana type.

"Further study of the rapid hydration reactions which generally characterize today's products is needed, especially from the standpoint of long-time durability of the concretes.

"These are only a few of the many problems which are still to be answered by research. The lack of knowledge hidden in these missing items may in many instances account for the present-day failures."

Portland Cement Production

PRODUCTION of 18,605,000 bbl. of finished cement in September, 1948, has been reported by the Bureau of Mines, representing a 7 percent increase over September, 1947. Mill shipments totaled 19,938,000 bbl., an increase of 0.5 percent above the September, 1947, figure, while stocks of 7,022,000 bbl. on September 30 were 11 percent below the September, 1947, totals. Clinker output in September, 1948, amounted to 17,961,000 bbl. representing an increase of 9 percent over the corresponding month of the previous year.

Produces Pumice

THOMPSON PUMICE COMPANY is producing pumice in considerable tonnage from the northwest end of Glass Mountain on the Medicine Lake Highland of Siskiyou County, Calif., the State Division of Mines has announced. The deposit ranges in depth from 6 to 40 ft., and the pumice, grayish-white, is said to be stronger than average natural pumice, occurring in particles which range in size from ¼ to 8 in. Estimated production for 1948 is 30,000 cu. yd., with output being utilized for concrete block, pre-cast reinforced concrete, soil conditioners, and dry wall insulation. Paul D. Thompson owns the company.

"Our Page AUTOMATIC has given 11 months of solid service without being taken off the rig for repairs."

says operator George Whiteside of Northern Illinois Coal Corp.

Unretouched photograph of Page AUTOMATIC after 11 months' service.

"THAT'S real performance in anybody's language and a record that helps us get top yardage consistently day after day.

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PAGE *Automatic*

DRAGLINE BUCKETS *and* **WALKING DRAGLINES**

Members of the A.S.T.M. committee C-7 gathered at the offices of the Azbe Corp. for a buffet dinner after the meeting. No. 1, left to right: Ansel Rogers, P. L. Rogers, Mrs. A. Rogers and guest. No. 2, left to right: Dr. H. E. Wiedemann, Dr. F. O. Anderegg, P. L. Rogers and Robert S. Boynton. And left to right in No. 3: Messrs. Rockwood, Voss, Wiedemann, Anderegg, Tanski, Andrew and Murray

A.S.T.M. Committees Meet in St. Louis

COMMITTEES C-1 on Cement, C-7 on Lime and C-9 on Concrete and Concrete Aggregates, of the American Society for Testing Materials, held their fall meetings in St. Louis, Mo., October 18-22. The membership of all the committees was well represented and many things of interest were discussed, particularly in the meeting of some of the subcommittees, which are now attended by about as many visitors as subcommittee members.

Of particular interest to all members of Committees C-1 and C-9 was a discussion of the subject of reactive aggregates. Progress is being made, but apparently not much of very definite value in solving the problem has been made to date, other than the fact that more attention is being paid to the role of puzzolans as possibly having some influence in prevention of concrete disintegration, in some instances at least.

Moreover, it appears that limestone dust, and even limestone sand and coarse aggregate, also have some as yet unknown function in arresting the detrimental results of a combination of high alkali cements with siliceous aggregates of certain kinds.

A fairly definite outline for continued research on this subject was adopted, of which we shall hear more later. Also, some extensive tests are underway to determine more definitely what makes a puzzolan react with hydrated lime. The results of tests already made by several laboratories on small cylinders composed of a mortar made of blended hydrated lime and various pulverized materials presumed to have puzzolanic properties show some remarkable strengths at the age of one year. The object of these tests is to develop a better means of determining the puzzolanic properties of the various materials by their reaction with lime, other than the time honored test with lime water.

Committee C-7 on lime met chiefly to reorganize the sub-committees, and if possible, to make an early start on its assignment of embracing the development of specifications for limestone for agricultural and metallurgical purposes.

The meeting of Committee C-1 was enlightened by a visit to the St. Louis plant of the Missouri Portland Cement Co. and a cocktail party at the hotel given by the company. The members of Committee C-7 were the guests on October 19 of Victor J. Azbe, consulting Lime plant engineer, at a buffet supper and cocktail party at his offices and laboratory.

Yolanda N. Rauert, Victor Azbe's secretary and hostess at the buffet dinner

Oklahoma Mineral Industries Conference

AN INTERESTING PROGRAM of technical and non-technical papers and a round-table discussion were presented at the Ninth Annual Oklahoma Mineral Industries Conference which was held October 12-13 in Oklahoma City. The meeting was sponsored by the Oklahoma Geological Survey, Norman, and the Industrial Division of the Oklahoma City Chamber of Commerce, and approximately 300 were in attendance.

The conference also included a week-long "Made-in-Oklahoma" Manufacturer's Exposition, the first of its kind ever held in the State. Exhibitors included: Thomas Concrete Pipe Co., Oklahoma City, Ada, and Lawton; Apache Calcite Co., Apache, producer of high grade agstone and poultry grits; and the Oklahoma Natural Gas Co.–Oklahoma Geological Survey which displayed mineral raw materials of the State. Failing Supply Co., Enid, exhibited a portable rotary drill of the kind used in deep prospecting.

Earl Wells, president, Starr Coal Co., Henryetta, presided at the luncheon program and afternoon minerals session on the opening day. Clarence Burch, Chairman, Oklahoma Planning and Resources Board, pointed out factors encouraging industry. S. B. Ireland, president, Cities Service Gas Co., Oklahoma City, presented a paper which in part covered Oklahoma nonmetallic minerals, which he said can be classed into three groups. One includes the relatively low cost materials of construction such as cement, crushed stone, gypsum, sand and gravel, brick shales, and mineral wool for insulation. Oklahoma has two cement plants, two gypsum plants, twelve brick plants and many producers of crushed stone, sand and gravel. There is one mineral wool plant and plans have been laid for a second and larger one. The second group includes those rare minerals having higher value properties, such as sheet mica, long-fiber asbestos, and industrial diamonds. Oklahoma has few or no commercial deposits of these minerals. The third classification includes minerals of certain chemical specifications necessary for a vast array of chemical, metallurgical and other industries. Oklahoma materials of this class are high purity silica sands, chemical grade limestone, and chemical grade dolomite.

The cement industry in Oklahoma was discussed by D. M. Tyler, first vice-president, Dewey Portland Cement Co., Bartlesville, who pointed out that the cement plant at Dewey and the Oklahoma Portland Cement plant at Ada together are producing about 3,000,000 bbl. of portland cement per year.

The growth and development of the glass industry in Oklahoma, stressing

(Continued on page 158)

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Perfect (?) Aggregates and Concrete

(Continued from page 92)

Sieves Nos. Passing	Retained	Cumulative Retained Percents
	No. 4	2.5
No. 4	No. 8	12.5
No. 8	No. 16	27.5
No. 16	No. 30	52.5
No. 30	No. 50	77.5
No. 50	No. 100	92.5
No. 100		8.0

This "ideal sand" then has a fineness modulus of 2.65, which is also the mean fineness modulus of the specification limits of not less than 2.40 or more than 2.90. This ideal sand is plotted on the chart, Fig. 2, to show its relation to the old specification limits. It is obviously a finer sand than the mean of the old limits (Fig. 1) which has a fineness modulus of 2.80.

If we take into account the limits set in the proposed specifications on the combinations of the bracketed sizes, we have approximate limits in size gradations shown by the dotted lines in the chart, Fig. 3. Against this is plotted the mean or ideal grading from the chart, Fig. 2, which apparently is on the coarse side of any grading that would meet the specification. It is difficult to see how any sand having a fineness modulus in excess of 2.77 could meet the other requirements.

The limitations on the fineness modulus are practically impossible of operating accomplishment, for having established a fineness modulus for the operation it must not vary "during normal operation" more than plus or minus 0.10, which means a variation of plus or minus 5 percent. And this limitation is on samples as delivered on the job site, making no allowance for segregation during transit, except that the contractor may elect to receive shipments in two or more size gradations and blend them on the job. At least nine out of ten samples must meet the size gradation test.

The interpretation of the specification we have given above is the one that has been accepted quite generally in the sand and gravel industry, but apparently it is not the official interpretation, for the Corps of Engineers, in supplying data to machinery manufacturers for design of processing plants to make a crushed fine aggregate, has supplied the following specification limits:

CORPS OF ENGINEERS' INTERPRETATION OF LIMITING SIZE REQUIREMENTS

Sieve No.	Cumulative Percent Passing	Max.	Min.
No. 4	100	100	100
No. 8	90 ±3	93	87
No. 16	75	78	72
No. 30	50 ±5	55	45
No. 50	25 ±5	30	20
No. 100	8	13	3
No. 200	3 ±3	6	0

This tabulation is in "Cumulative Percent Passing the Sieve Sizes," while that given previously is in percent retained between sieve sizes; but, according to the official Corps of Engineers' interpretation, the two tabulations mean the same thing. The chart, Fig. 5, has been plotted to show these specification limits as compared with the former 1946 limits (Fig. 1). While these are the official specification limits, it is obvious that the lower limit would not come within the fineness modulus limitation of 2.4, and the maximum limit would not permit a fineness modulus of as much as 2.90. Hence, the only conclusion we can draw regarding these size gradation specifications is that the Corps of Engineers' "experts" themselves are as badly confused regarding what they want as are the producers who are attempting to devise ways of meeting the specification. It may be that this situation will be clarified before this article is published, for indications are, and some changes in the personnel of the Corps of Engineers laboratory staff point, that way. In any event, a knowledge of the confusion, as it exists at this writing, should prove helpful to producers in future dealings with the Corps of Engineers.

Crushed Fine Aggregate

Theoretically the product of an ideal crusher conforms to a straight-line gradation. Such a chart ordinarily is used to make preliminary estimates of crusher size gradations. The actual chart, of course, varies with such factors as the type of crusher, crusher setting, kind of rock, whether the crusher is operated in open or in closed circuit with a screen or air separator. The chart, Fig. 4, shows the Corps of Engineers' ideal fine aggregate grading plotted against straight-line gradations with three assumed crusher settings (1) all through ⅜-in; (2) all through No. 4 sieve; (3) all through No. 8 sieve, with (1), (2) and (3) products all 95 percent retained on No. 100 sieve. Apparently the product of a crusher setting between the No. 4 and No. 8 sieve sizes would very nearly meet the specification, with a small percent of oversize allowed to pass. This would decrease the percentages retained on the No. 8 and No. 16 sieves to somewhere near the designed grading. It is obvious that the specification is much easier to meet with a crushed fine aggregate than a natural sand.

The grading of the coarse aggregate picks up where the fine aggregate leaves off and continues in a practically straight line, so that, in most instances where the same source is is used for both fine and coarse aggregates, the specifications are apparently designed to take practically the entire quarry run, with only the excess of fines removed—the voids in the mix to be completely filled theoretically with the cement paste.

It is apparently impossible to chart of coarse aggregate specification as a whole, and it would not mean much, since the material must be supplied in the size groups shown in the table: (1) No. 4 to ¾-in.; (2) ¾- to 1½-in.; (3) 1½- to 3-in.; (4) 3- to 6-in. These segregated sizes are to be recombined on the job in the proportions specified, dependent no doubt on the actual voids as determined by experiment. In order to discuss the coarse aggregate size specifications more intelligently we have plotted Fig. 6 which shows the straight-line proportions of a crushed aggregate for different crusher settings.

Assuming, therefore, that the crusher has approximately a 6-in. open-side setting, the line B, Fig. 6, would provide a product with approximately 15 percent retained on a 3-in. square mesh; or it would have, as the specification provides, approximately 15 percent in the 3- to 6-in. size range. Some 80 to 85 percent would be minus 3-in. By reference to line B we find about 20 percent would be in the 1½- to 3-in. range. This product may contain 5 percent oversize (over 3-in.). The product passing the 1½-in. and retained on the ¾-in. sieve would be between 20 and 30 percent by reference in line B in Fig. 6 with an allowance for 10 percent oversize, provided not over 5 percent of this exceeds 1-in. The product passing the ¾-in. and retained on ⅜-in. sieve by reference to line B, Fig. 6, would be between 20 and 30 percent. We would then have percentages retained:

3- to 6-in. size	15 percent (approx.)
1½- to 3-in. size	20 percent (approx.)
¾- to 1½-in. size	20 percent (approx.)
⅜- to ¾-in. size	20 percent (approx.)
⅜-in. to No. 4 size	20 percent (approx.)
Minus No. 4 size	5 percent (approx.)

The table converted to accumulative percents retained (Fig. 6) would be:

Size Gradings	Accumulative Percent Retained
3-in.	15
1½-in.	35
¾-in.	55
⅜-in.	75
No. 4	95
Passing No. 4	5

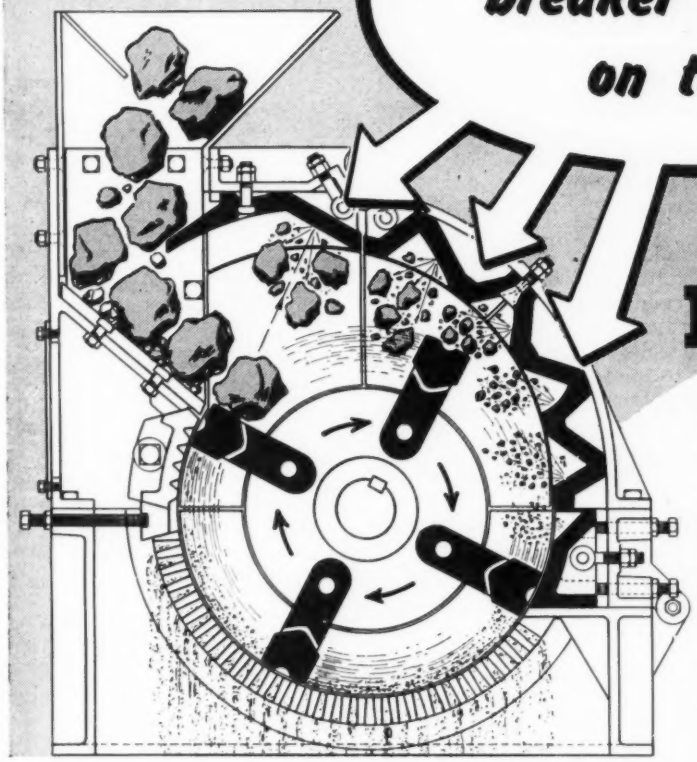
If the plus 3-in. size were recrushed, the percentages would be changed somewhat, and of course the same applies to recrushing the oversize between any two screens. For example, if the product over 3-in. in size of crusher B were recrushed we

(Continued on page 158)

COARSE AGGREGATE SIZE GRADATIONS

U. S. Square Mesh	Percent Passing Each Sieve: No. 4 to ¾-in.	¾-in. to 1½-in.	1½-in. to 3-in.	3-in. to 6-in.
7-in.				100
6-in.				90–100
3-in.			90–100	0–15
2-in.			20–55	0–5
1½-in.		90–100	0–10	
1-in.		20–45	0–5	
¾-in.	90–100	0–10		
⅜-in.	30–55	0–5		
No. 4	0–5			

There is a difference in HAMMERMILLS...



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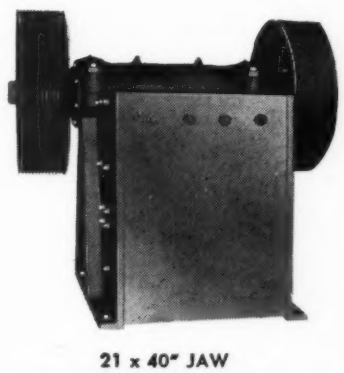

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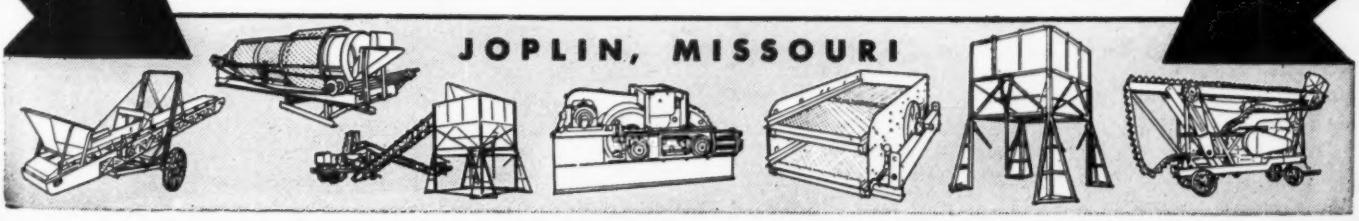

would get the approximate grading shown in line C on the chart, Fig. 6. If the product of this crusher exceeding 1½-in. in size were recrushed in crusher D, we would have a grading approximating line D, etc. Obviously, crushers C, D, E, etc. need not be separate machines, for the oversize, after taking out each fraction passing the limiting screen could be returned to the same crusher where some further reduction would take place. Evidently any producer having to meet this specification might be required to do considerable experimenting with crusher settings, closed and open-circuit crushing, and possibly need new reduction machinery if his particular crushed rock failed appreciably to follow a fairly straight-line grading, or the concrete proportioning required more of one group of sizes than another.

The Perfect (?) Concrete

The Corps of Engineers is planning on structures which are intended to endure for a minimum of 100 years. The problem to be solved then is: Has the answer to durable concrete been found? So far as the Corps of Engineers and its works are concerned that remains to be seen. In the meantime there are bound to be many arguments on the causes of concrete durability, or vice-versa, disintegration. That close grading of both fine and coarse aggregates, if kept within bounds of economic production, is a step in the right direction, probably no concrete expert will deny. This makes for workability with less mixing water and less cement requirements. The use of 10 percent of fine aggregate between the No. 100 and No. 200 mesh will also help workability, as will the entrained air.

The minus No. 100 fine aggregate would probably average about 100 microns in size, and the coarsest cement particle in present-day cements would probably average about 40 microns. That means a considerable gap in the grading, which it would seem, to be consistent, should require a more coarsely ground cement, or a cement more in line with the German portland cements used in the construction of their autobahnen. These concrete pavements have received much praise from concrete experts. If the contention of some cement specialists is true, that cement particles over 40 microns in size practically never hydrate, the fine aggregate should have enough particles passing the No. 200 sieve to fill the gap in grading between fine aggregates and cement.

Much experimental work bears proof that reactivity between aggregates and so-called high alkali cements can best be reduced or probably eliminated entirely, by using "more of the dog that bites." In other words if a rock or other mineral with a high content of reactive silica (that is a puzzolan) is interground with the cement, the chemical reaction between the alkalies and the silica is so well distributed in the mass of concrete as to be harmless, if, as a matter of fact, it is not positively beneficial. The actual chemistry of puzzolans in cements is no better understood than the chemistry of the hydration of cement itself, but the volume of evidence is growing that with most cements substitutions of the right kind of puzzolan for at least 20 percent or more of the portland cement, does increase both strength and durability of the concrete.

The Corps of Engineers' specifications leave the way open to use of portland-puzzolan cements, but they are not specified as yet, although the Bureau of Reclamation is beginning to look with favor on them. It should, because two of the most durable dams the Bureau ever built were constructed with so-called sand-cement, which was portland cement interground with a local sandstone in one case, and a siliceous rock (granite) in the other. After fighting "the adulteration" of portland cement ever since those dams and other structures were built of sand-cement, portland cement manufacturers are now waking up to the fact that maybe this is *the* way to make a cheaper and a better cement for large structures. If the Corps of Engineers overlooks this angle of making better concrete, it may be that all their other efforts will have proved in vain.

Oklahoma Conference

(Continued from page 154)

the part played by fuels, silica sand, and limestone, was outlined in a paper by Jay Randolph, Liberty Glass Co., Sapulpa. By 1920 there were 20 glass manufacturing plants in the State. Silica sand for glass manufacture is being produced from the Arbuckle Mountains. At present 14 plants are operating in Oklahoma. High quality limestone is being marketed from Marble City, and dolomite suitable for glass manufacture is being quarried near Troy.

At the conclusion of the afternoon session, a panel discussion was held on possibilities of new mineral industries led by Robert H. Dott, Director, Oklahoma Geological Survey. In the panel, Gerald W. Chase, Assistant Geologist of the Geological Survey, discussed the recent discovery of vermiculite in pre-Cambrian rocks of the Wichita Mountains, and A. L. Burwell, Industrial Chemist of the Geological Survey, described the production of cellular glass blocks and light-weight glassy grains from volcanic ash.

A morning session was devoted to industrial development and included six papers on the location of plant sites, availability of electric power and natural gas, and means of encouraging industry, after which the group adjourned and visited the Tinker Air Force base.

Rocky's Notes

(Continued from page 73)

is concentrated around relatively large particles of reactive aggregate, the result is an excessive sodium silicate reaction at one place, the absorption of all available water, with resulting osmotic pressure, which causes expansion. There is not enough lime accessible to this concentration to be effective in bringing about the formation of much insoluble calcium silicate, which would seal off the reactive aggregate from further attack by the sodium hydroxide. When the sodium hydroxide, reactive silica and hydrated lime are well distributed in minute amounts in the mass of concrete, the reaction is more uniformly distributed. When the reaction is ended, any sodium hydroxide left either is so scattered or combined as to be harmless, or it is eventually leached out in solution.

Other Important Factors

The second factor is the timing of these reactions. From the gradual increase in strengths of good puzzolan cements, it is obvious the reaction continues for a long time. Where concentrations of sodium silicate occur around pieces of reactive aggregates, there not only is not enough lime in proximity for the reaction, but as the alkalinity of the sodium silicate solution increases, the reaction with lime is correspondingly retarded, or possibly prevented. The hydration of lime is very definitely retarded the higher the pH value (alkalinity) of the water used for hydration. Possibly the actual hydration of the lime particles, or the cement particles containing the lime, near the sodium hydroxide or silicate concentrations, is so retarded that delayed hydration accounts for some of the expansion. If the reactive aggregates were surrounded by a matrix of sodium silicate, hydrated lime and finely pulverized active silica, the formation of calcium silicate would go on much faster with the puzzolan rather than with the coarser aggregates for the simple reason that the puzzolan has far more surface area. This would result in scaling off the reactive aggregates and prevent their further solution.

If we read the literature on concrete intelligently, experiments and experience with puzzolan cements and reactive aggregates verify this conclusion. Of course, the chemistry of hydration, curing and hardening of portland cement concrete is not so simple as outlined above, because we have gypsum (calcium sulphate) and various other substances in the cement and in the percolating water and air to consider. Nevertheless, there appears no reason to believe that high alkali cements are inherently bad cements. They may be the reason why Elephant Butte dam concrete is good.

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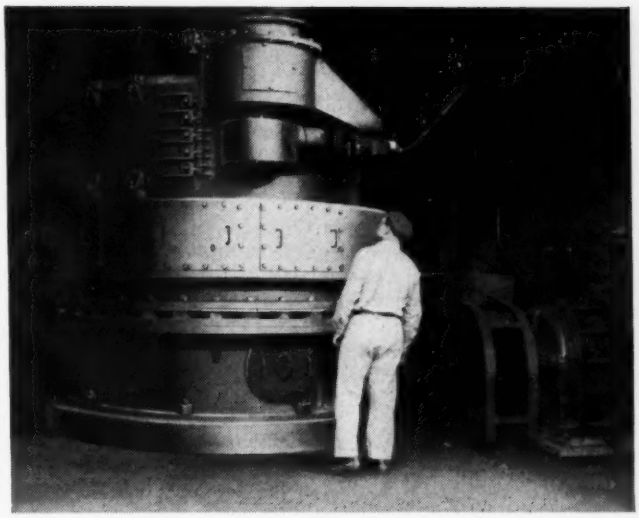

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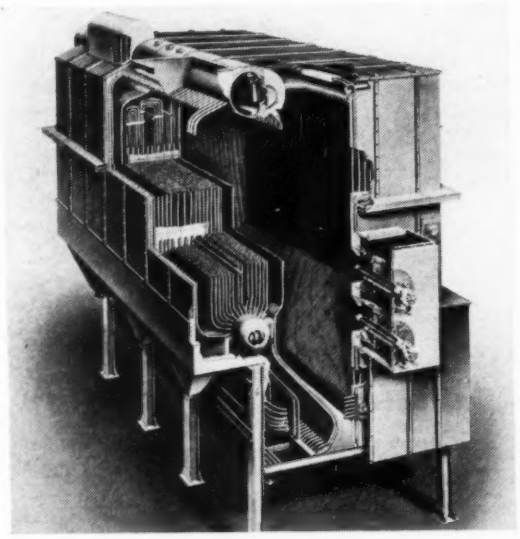

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Operating Division Meeting of Lime Association

(Continued from page 97)

proaching load in the kiln—the burner pipe is 8 in. to the side of the hood center and 6 in. below the center. The resulting flame is described as "short and bushy."

Irving Warner, Philadelphia, Penn., said that he thought the exact location of the burner was critical; that conditions for every kiln would be different. He thought what was taking place in the New England Lime Co. kilns was that the coarser particles of coal were dropping out and being "smothered," so to speak, in the load of lime near the end of the kiln. This prevented their combustion in the hottest zone of the kiln where reaction with the lining takes place and rings are formed. The place or places where the combustion air is admitted may be a factor. The objective is to get a slower mixture of fuel and air and delayed combustion, instead of all combustion in one hot zone.

One operator told of spraying the ring using a ¾ in. pipe bushed down to ⅜ in. and, with city water, pressure-sprayed the ring with consecutive treatments that were from one to three hours apart. As the kiln revolved, the water was applied in just enough amounts as to cause no puddling. He said that at first there was no apparent change in the ring except that it turned black; however, after from one to three days the ring would sluff off in layers and all come out. He stressed the fact that under some conditions the brickwork might pop out also but his experience had been favorable and as above indicated. He repeated the water treatment each day until the ring was removed. Mention was made by others of a boring bar made by Allis-Chalmers Manufacturing Co. that was designed to cut out rings continuously. Also mentioned was the possibility of melting out the ring by increases of temperatures in the hot zone.

Blasting

Another question related to the best place to put the primer in a drill hole, whether at the bottom of the column of powder or higher up in the hole. One operator using Primacord gave his opinion that it was just as well to put the primer at the top of the charge on the theory that if the hole missed it was easier to remove the primer and powder. One operator, speaking of delayed aciton blasting, said he had had to cut his charge from 3 to 1 to 2.7 to 1 to get good results but his fragmentation was better.

Putty Temperature

On the subject of temperature of putty related to mixing temperature, it was stated by one speaker that as temperature (within limits) goes up, the plasticity goes down, and that 80 to 85 deg. F. was the critical temperature in his case, above which the putty started to go bad. The effect of hot and cold water when mixing putty was also discussed.

Bucket Elevators

One question asked was how to keep a bucket elevator from backfiring, and it was pointed out that speed of elevators was very important; they can be run too fast and too slow for satisfactory performance. Drilling holes in the bottom of the buckets to destroy suction was suggested. One operator had trouble with his elevator and tried aluminum and galvanized buckets, with no improvement; correct speed was the answer.

Absenteeism

On the subject of how absentee labor, especially of key men, could be penalized for being absent without previously notifying the employer, one man said it cannot be done. Another spoke of a bonus amounting to $5 per two weeks or $10 per month for constant attendance. If this is used it must be a firm rule. If the employe is off due to illness on doctor's orders, 40c per day is deducted from the above. Another told of pulling the absentee's time-card and inserting one of a different color which the employe signs on his return. It is just a reminder that he has played hooky. The card becomes a part of the man's permanent record at the plant. Another operator told how a non-negotiable check was sent to the man's wife. The check was for the exact amount the man would have earned had he not been absent.

Instrumentation

Irving Warner gave a paper on instrumentation of rotary kilns. It gave more or less in detail his ideas on the subject, but as a generalization, Mr. Warner felt that some of the information given by many instruments was useless but that others were valuable in that they assisted the operator to know what was going on in the kiln. Automatic control of kiln operation by instrumentation, in Mr. Warner's opinion, was not especially desirable or possible on account of the many variables. He said that switchboards for kiln instruments were as a rule too crowded, and room for additional instruments or for changes should be provided. He did not like circular charts but preferred the strip type and said that instruments where the pointer had to be looked at through a window were far less desirable than where the whole face of the instrument was open.

Packaging

Slides were shown by several operators showing how they loaded cars with sacked lime. Much interest was evidenced by the group in the details of car loading. Irving Warner showed the perforated loading plate that he had developed over the years. This is essentially for outside loading. The perforations are to make the plate lighter, yet that part of the plate that gets the most wear from truck wheels is left unperforated. A long bolt dropped vertically through one of the perforations also prevents it from slipping under the impact of truck wheels.

Pictures were shown of the loading operations at Gibsonburg, Ohio, featuring 4-wheel trucks. One shot was of a Marion loader used for handling bulk lime. This device was assembled to the front end of a Chevrolet truck and the loaded bucket passes over the top of the cab to unload itself. Slides taken at the Luckey, Ohio, operation of the National Gypsum Co. included a ratchet car door closer. This is a light chain device made by Edelblute Mfg. Co., Reynoldsville, Penn., for closing or opening car doors. One operator who saw the picture pointed out that should the car door come off the hangers it might possibly injure the workman operating the device. It was pointed out that this accident hazard could be eliminated by a different choice of hook-up.

Loading Operations

Arnold H. Nieman and Fred Witmer, Jr., Ohio Hydrate and Supply Co., described their loading operations at Woodville, Ohio. Here they have a sectionalized conveyor system for loading sacked lime into the cars. They have seven of these short, low-hung, conveyors, each powered by ½- to ¾-hp. motors. The belt is 14 in. wide and is a lightweight crepe belt. It is a custom-designed installation and was supplied by the Bearing and Transmission Co. of Findlay, Ohio. The conveyors are provided with skid plates between each unit, and the belts are reversible. In the car are placed three short units, the end one being a stacker unit. The other four units are assembled at the machine used and once installed they can load 27 sacks per minute. It was pointed out that this installation cost about $4000 and does not save any money but it was installed because it was difficult to get men to do the sacking and loading, especially during the hot weather. Now older men can do the work. The rate of travel of the belts is progressively faster from the sacker onward. They start at about 70 f.p.m. and end at 90 f.p.m. Mr. Witmer said that if he was to do it over he would make the installation permanent and use faster speeds on the belt.

A representative of the St. Regis Sales Corp. showed pictures of some recent developments in car-loading devices that handle sacked material into the cars. Pallet loading was briefly discussed along with "slip-over" bags. One company representa-

tive said eight bags are put in a car for short hauls (100 miles or less), 12 bags for medium distance hauls, and 15 bags for the longer hauls. All producers were requested to bring samples of their car-loading tickets to the next meeting for exhibit and study.

REGISTRATION

Aluminum Co. of Canada, Ltd.
H. Jomini
Wakefield, Quebec, Canada

Ash Grove Lime & Portland Cement Co.
Carl L. Morris
Springfield, Mo.
Paul Sunderland
Kansas City, Mo.

Atlas Lime Co.
John P. Sheehan
El Paso, Texas

Azbe Corp.
Victor J. Azbe
St. Louis, Mo.
Gordon R. Lacy
St. Louis, Mo.

The J. E. Baker Co.
John A. Sechrist
York, Penn.

Building Products & Coal Co. Ltd.
Paull Kelpin
Winnipeg, Canada

G. & W. H. Corson, Inc.
Bolton L. Corson
Plymouth Meeting, Penn.
Philip L. Corson
Plymouth Meeting, Penn.

Cutler-Magner Co.
Henry LaLiberte
Duluth, Minn.
Paul LaLiberte
Duluth, Minn.

The Dow Chemical Co.
L. N. Carmouche
Ludington, Mich.
C. Stielstra
Ludington, Mich.
W. J. Rave
Freeport, Texas

Gypsum, Lime & Alabastine, Canada, Ltd.
J. H. Robinson
Toronto, Ont., Canada
W. T. Unsworth
Hespeler, Ont., Canada

Jewell Ridge Coal Corp.
Huston St. Clair
Tazewell, Va.

The Kelley Island Lime and Transport Co.
J. V. Andrews
Cleveland, Ohio
H. M. Beatty
Cleveland, Ohio
Ralph L. Dickey
Cleveland, Ohio
F. R. Dittoe
Cleveland, Ohio
Russell G. Greeves
Cleveland, Ohio
L. E. Smith
Cleveland, Ohio

Lime Industry, Management & Engineering
C. R. Atherton
Hershey, Penn.

The Marble Cliff Quarries Co.
R. W. Bowen
Columbus, Ohio
C. B. Geiger
Columbus, Ohio
J. O. Leonard
Lewisburg, Ohio

Marblehead Lime Co.
Joseph M. Gentry
Hannibal, Mo.
James E. Jackson
Chicago, Ill.
John C. Lanham
Thornton, Ill.
C. W. McElhany
South Chicago, Ill.
L. H. Niems
Chicago, Ill.
Clarence Stolberg
Hannibal, Mo.
E. Tanski
South Chicago, Ill.
Oliver Stolberg
Marblehead, Ill.
Robert A. Temple
Chicago, Ill.
Wallace E. Wing
Chicago, Ill.
Harold Schmaltz
South Chicago, Ill.

H. E. Millard Lime and Stone Co.
E. D. Williams

(Continued on page 162)

Annville, Penn.
National Gypsum Co.
F. C. Mattery
Luckey, Ohio
National Lime Association
Robert S. Boynton
W. T. Harvey, Jr.
Gladys L. McBee
Washington, D. C.
National Mortar & Supply Co.
J. J. Butler
Gibsonburg, Ohio
W. W. Sprague
Pittsburgh, Penn.
New England Lime Co.
W. J. Ash
Canaan, Conn.
Frank S. White
Adams, Mass.
North American Cement Corp.
E. F. Alderton
Martinsburg, W. Va.
Ohio Hydrate & Supply Co.
Arnold H. Nieman
Woodville, Ohio
Fred Witmer
Woodville, Ohio
Fred D. Witmer, Jr.
Woodville, Ohio
Peery Lime Co.
J. A. Dunaway
North Tazewell, Va.
Pit & Quarry
Edw. J. Brunenkant
Chicago, Ill.
Walter E. Trauffer
Chicago, Ill.
Rock Products
Walter B. Lenhart
Chicago, Ill.
Nathan C. Rockwood
Chicago, Ill.
Bror Nordberg
Chicago, Ill.
Rockwell Lime Co.
T. E. Slattery
Manitowoc, Wis.
St. Regis Sales Corp.
John H. Deacon
Toledo, Ohio
St. Regis Sales Corp.
Burton A. Ford
Allentown, Penn.
United States Gypsum Co.
J. S. Offutt
Chicago, Ill.
United States Gypsum Co.
W. R. Burgoyne
Chicago, Ill.
Utah Lime and Stone Co.
T. R. Ellerbeck
Salt Lake City, Utah
Warner Co.
Reed C. Bye
Philadelphia, Penn.
A. C. Hewitt
Bellefonte, Penn.
Irving Warner
Philadelphia, Penn.
Lea P. Warner, Jr.
Philadelphia, Penn.
Winnipeg Supply & Fuel Co. Ltd.
R. G. Foster
Winnipeg, Canada

Letter to the Editor

Dear Sir:

I have just been reading the article on page 149 of the October issue of ROCK PRODUCTS relative to the meeting of cinder block producers in Atlantic City. It must be quite obvious that your reporter misquoted me when he reported that I said "cinder block producers were growing fewer and fewer as more block producers turned to fly ash." My only reference to fly ash was in response to a question from the floor concerning information on the use of fly ash in the manufacture of cinder block. I replied to the effect that fly ash was being used as one of several admixtures in one of our research programs currently in progress. These tests will not be completed for several months and consequently we have no special information to release at this time.

E. W. DIENHART
Executive Secretary
National Concrete Masonry Association

Gradation

(Continued from page 101)

selecting one that has ample capacity, for if it becomes overloaded, naturally a portion of the plus 100 mesh material will be removed from the product. The air separators do not operate as efficiently when the material is wet as when dry; therefore, when wet conditions do exist, production in the sand line must be reduced in order to maintain gradation. Air separators do remove minus 100-mesh material very uniformly, and have several adjustments which can be made, such as adding or removing the selector blades, adjusting the control valve, etc., so that the desired proportion of minus 100 can be removed.

Dual-Flow Plant

If the silica content of the rock which produces wear in the crushing equipment exceeds 4 percent to 5 percent, or if there is not sufficient market for the excess minus 100 material, I would recommend that all aggregate fed to the sand line be reduced to ½-in. or ⅜-in. size by either roll crushers or cone crushers. A flow plan of a typical sand plant which employs the principle of splitting the sand into two sizes is shown herewith (Fig. 2).

Two air separators (No. 15 and No. 16) are shown in the system. Only one may be required, depending upon the production desired. Items No. 3 and No. 4 are the two hammermills used in the operation, and item No. 24 is a ring-roll mill for which a hammermill could be substituted if there is a market for the minus 100-mesh material.

The material flow of this sand line is as follows:

Volumetric feeders No. 1 and No. 2 receive the minus ½-in. stone from the surge bin, and feed the material to the two hammermills (No. 3 and No. 4). Material is then carried to two double-deck vibrating screens (No. 7 and No. 8), the feed being adjusted to each screen by the swing gate and two-way chute (No. 6). The bottom decks of both screens have No. 16 wire; the top deck of screen No. 7 has No. 8 wire; the top deck of screen No. 8 has No. 4 wire. The top deck of No. 7 may be varied to as small as No. 10 mesh, if the gradation requirements warrant it. This gives an added control for further blending of the product.

The throughs from the top deck of both screens are returned to the surge bin (No. 10) which is fed by apron feeder No. 11 which has a two-way chute with adjustable swing gate and returns this product in desired quantities to the ring-roll mill (No. 24) and the apron feeder (No. 2). Material crushed by the ring-roll mill is returned to the main conveyor (No. 5), thus closing the crushing cycle in the sand line.

The portion of the minus 4 plus 16 mesh material which is not returned to the crushing line for further reduction is reblended with the minus 16-mesh sand at the end of the operation. The minus 16-mesh throughs from the bottom decks of screens No. 7 and No. 8 are fed by conveyor No. 14 to the two air separators (No. 15 and No. 16.)

To provide an additional control on minus 100 mesh material, one air separator may be provided with a two-way chute and swing gate at the feed point, as shown (No. 15) for by-passing part of the product directly to the finished product on conveyor No. 20. This control will compensate for any coarseness in the product which may occur and thus reduce the feed to the air separator. Feeding the minus 16 mesh material only to the air separators also reduces the load and wear on the inner parts of the separator, the latter being advantageous especially when the silica content is above 4 to 5 percent. Should only one air separator be required, it is advisable to provide this two-way chute also.

The finished sand, 16 to 100 mesh, discharges on to conveyor No. 20 and is blended with correct proportions of 4 to 16 mesh product with feeder No. 13. The minus 100 mesh material is conveyed to the waste bin (No. 19).

Minus No. 4 screenings from the coarse aggregate production line, which contain slivery-shaped particles, are fed to the sand line by feeder No. 22. The minus 16-mesh throughs removed by the single deck screen (No. 23) discharge directly to the main sand line on conveyor No. 5. The 4 to 16 mesh product retained on the top deck should be returned to feeder No. 2 for further reduction to a cubical shape by hammermill No. 4. Generally, it will be found that screenings which are slivery-shaped will be in the 16-mesh size, which is the reason for the above recommendation. This screen size may be varied to suit the product. These screenings will also vary in gradation and quantity, which necessitates the installation of feeder No. 22.

The importance of controls for blending cannot be over-emphasized. A very essential feature in designing a sand plant is to provide ample controls for blending to meet gradations required. These controls should be designed so that they can be adjusted quickly while the plant is in full operation.

Fiberglass Shingle

FISCHER LIME & CEMENT CO., Memphis, Tenn., has perfected a new type shingle, the Fiberglass insulation shingle. The product is made by cutting a brownish fiber glass in strips, placing a shingle over them, and compressing. The shingle and glass stick together, and the product is said to eliminate the need of other attic insulation.

Labor Relations Trends

(Continued from page 75)

further suits of similar character the Congress passed the Portal-to-Portal Act, as an amendment to the F.L.S.A., —incidentally the only amendment to the Act ever enacted.

The lower courts have quite generally sustained the constitutionality of the Portal-to-Portal Act. This was the only angle from which it could be attacked. The United States Supreme Court has now (November 15) passed on the issue, in two cases on its docket by refusing to review lower court decisions. So far as known there is no widespread objection to the Act on the part of organized labor, since it has been able to make good use of it in collective bargaining to gain the same end.

Right to Have a Job

Some of the state legislatures had begun to act on laws designed to assure a person's right to get and hold a job, regardless of whether he belonged to a labor union or not, before the Congress enacted the Labor-Management Relations Act (Taft-Hartley). One of these states was North Carolina, whose legislature had adopted a Right-To-Work Statute early in 1947, prior to the passage of the L.–M.R.A. This law was specifically aimed at closed-shop rackets, of which the A. F. of L. building trades unions were good examples. It will be recalled that during the war some of these unions exacted enormous fees from would-be non-union workers for "temporary" permission to hold jobs, and while this practice was condoned by the Federal Government it aroused widespread public indignation.

Hence, our March, 1948, Trends article contained a rather comprehensive digest of the decision of the Supreme Court of North Carolina in the first case to come before it for violation of its Right-To-Work Statute. This case involved the usual form of closed-shop agreement between a number of building trades unions and a building construction contractor, in open defiance of the law. The court's decision is a classic and we suggest readers refer to it, because the issue will soon become a national issue again. In brief the court held that the Right-To-Work Statute was not a violation of the Constitution of the United States, or of the Constitution of the State of North Carolina, but a legitimate exercise of the police power of the State. The court pointed out the absurdity of the labor union attorneys' arguments that laws outlawing the so-called "yellow-dog" contracts were constitutional, while a complimentary law outlawing closed-shop contracts was unconstitutional. The A. F. of L. unions fought through the case with their very top-most legal talent.

That case, and another which arose under a similar state law in Arizona,

is being argued before the United States Supreme Court as this article is written, and its decision may be announced before this article is published. Such state laws are specifically permitted to be extended to union-shop contracts in the Taft-Hartley Act, which prohibits closed-shop contracts, but permits union shop under specific conditions. However, this prohibition of closed-shop contracts is the feature of the Taft-Hartley Act which arouses the most ire of labor union officers, because it prevents their absolute power to make or break their members. The agitation for the passage of the North Carolina, Arizona, Tennessee, Nebraska, and other states' right-to-work laws came as much from union members themselves as from the rest of the public. The Arizona law was suspended in application for several months in 1948 until confirmed in the November election by a constitutional referendum. Nevertheless, the union leaders and the President-Elect have so misrepresented the real character of the Taft-Hartley Act and these similar state right-to-work laws, that it is anticipated the Act will be rewritten to legalize closed-shop contracts. Consequently, the Supreme Court's decision in the North Carolina and Arizona cases will be of tremendous significance. It is the last ray of hope for preserving any vestige of the rights of the individual states to manage their own concerns according to the wishes of their own citizens, or the last bulwark against genuine "slave labor," so far as labor union members are concerned —and today there are 16,000,000 of them. This factor was discussed in the May, 1948, Trends article.

Law Applied to Construction

The April, 1948, article contained the announcement of Robert N. Denham, general counsel, National Labor Relations Board, that he was going to extend application of the National Labor Relations and the Labor-Management Relations Acts to local construction industries, on the theory that they "affected" interstate commerce, as defined in the L.–M.R.A. One of the first suits against a secondary boycott in the building trades was brought before the Federal District Court in Denver, Colo., (Trends article, June, 1948), and was thrown out of court on the ruling that local construction *did not affect* interstate commerce within the meaning of the Act. The N.L.R.B. has since had several similar cases, and in some instances has refused to interfere, without conceding its contention of coverage.

The latest court case to come to our attention prior to this writing was decided in the Federal District Court in Chicago on November 10, when a preliminary injunction was issued against an A. F. of L. glazers union to enjoin it from withholding glazers from Joliet, Ill., contractors who were in-

stalling preglazed windows in home-building projects. Hitherto if preglazed windows were delivered on the job, the union had insisted on taking out the glass and resetting it at an estimated additional cost to the home builder of about $80. The court said: "The evidence clearly establishes violations of the Act and the responsibility of all the defendants (the union officials, who insisted that they had not called a strike, but that the men quit of their own volition).

There is no doubt that the building trades unions will put up a fight to have this part of the Taft-Hartley Act repealed, because it seriously interferes with widespread local rackets and "make work" practices. In view of the President-elect's promise to provide more and cheaper housing there obviously will be conflict with his other implied promises to support labor unions in their demands. The Supreme Court, as yet, has not been appealed to for a ruling on the secondary boycott provisions of the Taft-Hartley Act, but there is said to be considerable strength in Congress opposed to the repeal of this provision. The building trades unions have a weak case legally and a still weaker one so far as support from public opinion is concerned.

"Legal" Profit-Sharing Plan

Many employers, particularly in relatively small, intimate organizations have had, or have desired to establish, some kind of a profit-sharing plan for their employes, but gave them up or abandoned plans because of various court decisions to the effect that such bonuses or payments must be considered part of the "regular rates of pay" in computing overtime. In the July, 1948, Trends article we described a plan that seemed capable of fitting any small manufacturing operation. Briefly, the company set up a "production savings plan," designed to promote efficiency and make the company better able to meet competition.

This was accomplished by placing a percentage value (based usually on the previous year's labor cost) on all products entering the final inspection department for the period. If this fund exceeded the amount actually paid in wages during the period to all employes for both straight and overtime, the difference, which represented a saving over previous costs, was distributed *pro rata* to the employes, as a percentage of the total earnings of each individual, including his premium overtime. The profit-sharing bonus did not depend entirely on individual efficiencies, or on workmanship alone, since the employes profited the same from installation of improved machinery, improved engineering service, more effective sales and management. There was no provision for reducing wages or recovering from employes if the payroll exceeded the production savings fund.

The U. S. Circuit Court of Appeals at Cincinnati, Ohio, upheld the plan as both simple and effective in making provision for overtime in conformance with the Fair Labor Standards Act. The disgruntled employes who brought the action, or their union (for unions are generally hostile to profit-sharing, since it brings employes and employers closer together) contended that the bonus, or profit-sharing fund, should be distributed on a straight-time basis only, which would have greatly increased the alleged overtime rate. In this case it would have meant a liability for the employer amounting to $1,500,000, although there were only about 400 employes. The employes appealed to the U. S. Supreme Court for a review of the lower court decision, and one of the first acts of the Supreme Court at this Fall session was to deny a review, so that now the lower court decision, as abstracted in our July Trends article, stands against all further challenge.

E. C. Schroeder Co. Cases

The two cases brought by the F.L.S.A. administrator against a crushed-stone producer in Oklahoma are important to many mineral aggregate producers, ready-mixed concrete manufacturers, concrete products manufacturers and agricultural limestone producers who have attempted to keep shipments within their own state boundaries to avoid coming under the Wage and Hour law. The Trends article in the August, 1948, issue reviewed these two cases. The first involved employes who were employed getting out crushed stone to be used in construction of a new section of state highway and relocated railway tracks around an area to be flooded in the construction of a Federal dam. Counsel for the National Sand and Gravel Association entered the case, when the producer lost in the U. S. District Court. The Circuit Court of Appeals, by a 2 to 1 (three judges) decision, reversed the lower court and held these particular employes were not covered by the law.

However, one of the judges based his dissent from the lower court's decision upon the fact that these construction works were not at the time the crushed-stone producer supplied the stone "instruments of interstate commerce." He inferred that his decision would have been different if the job had been supplying the material for maintenance of an interstate means of communication, which the highway and railway became when completed. The second case involved the same employes who also supplied crushed stone for construction of a dike around some petroleum installations to prevent their being flooded. In this case the same Circuit Court of Appeals and the same judges again over-ruled the lower court, but this time in the opposite direction—against the employer, for the lower court had

ruled that while the employes supplying the highway and railway jobs were covered by the Act, the employes supplying stone for the dike were not. The Circuit Court of Appeals now said they were, again by a 2 to 1 decision, the one judge who was doubtful in the first case, having decided the opposite way in the second. In both instances the U. S. Supreme Court was asked to review the Appeals Court decision, in the first by the F.L.S.A. administrator and the employes, and in the second by the employer. The high court denied review in both instances, so both decisions now stand, much to the adversity of the employer and the confusion of the industry. Under the same kind of reasoning the F.L.S.A. administrator contends that employes of producers of agricultural limestone come under the law if the farm crops raised on the land that is limed with their material subsequently move in interstate commerce. Apparently no such case has yet reached the courts.

It seems likely that the coverage of the wage and hour law will be extended both by the courts and by the Congress rather than narrowed. This is important especially if the minimum wage is increased to 75c per hour. The two year statute of limitations applies to many cases, perhaps, but probably no employer is entirely safe if he is not operating in compliance with this law.

Industrial Sand Meeting

(Continued from page 136)

be seeking greater benefits and liberalization of compensation laws.

Industrial Hygiene

Theodore F. Hatch, Industrial Hygiene Foundation, discussed developments in the field of industrial hygiene, covering particularly the present status of treatment and research work in silicosis, and codes.

In discussing treatment for dust diseases, he commented on work presently being conducted at Jefferson Medical School, Philadelphia, Penn., under sponsorship of the Health and Welfare Fund of the United Mine Workers which encompasses medical care for disabled anthracite miners, the training of physicians for work in anthracite mining regions and research. In recognition of the fact that silicosis of itself does not cause death or disability, but does so only with accompanying infection, inhalation therapy is under study whereby medication is inhaled to destroy infections. In the process, a drug is administered which dilates the air passages, more than doubling lung volume, in order that medication may reach all the way to affected areas. As an adjunct, a face mask developed during the war is used whereby pressure breathing is employed in the therapy.

Thusfar, no satisfactory method has been developed to measure degree of improvement under treatment. The

problem is being approached from the standpoint of the rate of gas exchange between the lungs and the blood rather than on the basis of ventilation rate. Work is being expanded in correlating working conditions with development of the disease.

Aluminum therapy and the practice of dispersing aluminum dust in change houses were briefly discussed. This development, now of 10 years, is a preventive measure, not a treatment, but Mr. Hatch said some 25 or 30 years must pass before its value may be definitely proved. So, aluminum therapy is being practiced on silicotics to determine whether or not improvement follows. At present some 15,000 men are being so treated in the United States.

At the University of Colorado, control tests have been set up whereby some workers are receiving aluminum therapy and others are not but believe they are being treated. The physicians in charge do not know which of the men actually receive the treatment. The men reported how they felt. Fifty percent of those who received the treatment reported improvement but, on the other hand, 50 percent of the others who believed they were being treated also reported improvement. Thusfar the experiment is limited. Mr. Hatch believes the solubility theory, basis of aluminum therapy, is sound but that the treatment has not yet been proved or disproved.

In research, the relation of size of dust particles to depth of penetration into the lungs requires much study in his opinion. It is recognized that the great bulk of inhaled dust particles do not ever reach areas of the lungs where they become trapped permanently, but, he said, it is of importance to know which sizes of particles are most likely to be trapped.

It has been concluded from studies in South Africa that particles greater in size than ten microns and those smaller than one-half micron are of no consequence because particles larger than ten microns were not found in workers' lungs and because particles less than one-half micron in

sizes were not supposed to be produced in plants. In commenting on these conclusions, Mr. Hatch said that in his opinion grinding produces many particles less than one-half micron in size, citing that some 90 percent of the number of particles in a bag of ground flour fall in that size range.

A study at Columbia University has shown that most dust particles retained in the lungs are around one micron in size. Other studies show that retention decreases with size particles down to one-quarter micron but when particles are smaller that molecular effects on the order of Brownian movement cause retention to increase. Mr. Hatch said that one of the difficulties is that dust counters in use today are limited to a minimum of about one micron in size of particle and therefore smaller particles have had to be ignored. The New Jersey Department of Labor code to set rules and regulations for the control of silicosis, now being considered for adoption, will cover only silicosis and all industries involved except foundries. This code, he said, is being written around permissible dustiness and lists methods for control of dust. Some of the questions raised by Mr. Hatch in objection to the code as originally drafted have to do with interpretation in the handling of wet sand. Handling wet sand is not a dusty operation, but the original writing of the code was such that the practice might have been held to be illegal. He believes that the writing of a specific code for a particular industry, such as this one, is at least an attempt in a sound direction. In conclusion, he said that the American Conference of Industrial and Government Hygiene is trying to write a single model code for industrial hygiene. This organization has no legal standing but its recommendations would carry some prestige.

Basing Points

Thomas Austern, a partner in the law firm of Charles A. Horsky, gave a very clear and informative discussion of the recent decision of the United States Supreme Court in the cement case, which invalidated basing point pricing systems. One thing that was pointed out clearly and with definiteness was that there is only one safe way of selling cement and other heavy goods and that is by sticking to f.o.b. plant pricing, to which the freight to destination is added. All is apparently confusion among economists and lawyers who would attempt to determine the legality or illegality of other systems of pricing. Among the systems discussed were single basing point selling—the so-called Pittsburgh plus system—multiple basing point selling, national uniform delivered pricing, zoned delivered pricing, and freight equalization in f.o.b. selling through absorption of freight charges. The question is whether or not any of these systems is now legal

and, it seems, lawyers cannot agree on the answer.

The Federal Trade Commission has said that in delivered pricing or where freight is absorbed, the offense is conspiracy in violation of the Sherman Act. The real question involved is proof that there was agreed-upon uniformity of practices.

In multiple basing point pricing, the question becomes one of whether or not there is violation of the Robinson-Patman Act, which prohibits charging a higher price to one customer than another where competition is thereby injured. The F.T.C. has said that net realized at the factory is the governing factor when the product is sold on a delivered price basis, which means that a customer located nearer to a plant than another should get a lower price. The trouble is that many vague interpretations are being given, such as that it is probably all right to quote discriminatory prices to meet competition in some cases but only if done now or then, or that the probability that a pricing system may have been injurious between competitors is sufficient evidence to cause a cease and desist order to become effective, etc., etc.

Whenever companies are engaged in delivered price selling, in order not to end up with matched prices, it apparently would be necessary in order to be safe for the seller to be indifferent to whom he sells and for the buyer to be indifferent from whom he buys, as Mr. Austern appropriately expressed it. As far as the cement case is concerned, he said that only one thing was decided and that was that there had been conspiracy according to the Court.

In discussing penalties, he cautioned that treble damages and criminal liability may be imposed in cases of conspiracy or price discrimination. Both buyer and seller are guilty where the Robinson-Patman Act has been violated. In conclusion he said that the industrial sand industry is in the clear because its products are priced f.o.b. plant plus freight but may be effected because of the impact on its customers.

Registration

Mr. and Mrs. V. P. Ahearn, National Industrial Sand Association, Washington, D. C.
Mr. and Mrs. James B. Bergs, Pioneer Silica Products Co., St. Louis, Mo.
Mr. and Mrs. E. J. Campbell, Sun Sand Co., Thayer, W. Va.
Mr. and Mrs. Harte Campbell, Sun Sand Co., Thayer, W. Va.
Mr. and Mrs. W. J. Cannon, The Nugent Sand Co., Muskegon, Mich.
Mr. and Mrs. Robert R. Coxey, Industrial Silica Corp., Youngstown, Ohio
Mr. and Mrs. J. S. Coxey, Jr., Industrial Silica Corp., Youngstown, Ohio
Mr. and Mrs. Russell Cronenweth, Great Lakes Foundry Sand Co., Detroit, Mich.
Mr. and Mrs. E. M. Durstine, Keener Sand & Clay Co., Columbus, Ohio
Mr. and Mrs. Sterling Farmer, Sand Products Corp., Cleveland, Ohio
Mr. and Mrs. A. Y. Gregory, Whitehead Brothers Co., New York, N. Y.
Mr. and Mrs. C. M. Hardy, Hougland and Hardy, Evansville, Ind.
Mr. and Mrs. R. S. Lebold, Michigan Silica Co., Rockwood, Mich.
Mr. and Mrs. Carter H. Manny, Producers Core Sand Corp., Michigan City, Ind.

T. C. Matthews, Pennsylvania Glass Sand Corp., Lewistown, Penn.
John H. Miller, Mifflin Sand Co., Lewistown, Penn.
Mr. and Mrs. Jesse T. Morie, Jesse S. Morie & Son, Mauricetown, N. J.
Mr. and Mrs. R. W. Muhlitner, Great Lakes Foundry Co., Detroit, Mich.
Mr. and Mrs. Wm. Paddison, Great Lakes Foundry Sand Co., Detroit, Mich.
Mr. and Mrs. P. W. Palmer, Browntown Silica Co., Browntown, Wis.
Mr. and Mrs. Forrest S. Pearson, Standard Sand Co., Grand Haven, Mich.
Mr. and Mrs. Joel G. Pearson, Standard Sand Co., Grand Haven, Mich.
George F. Pettinos, Jr., Cape May Sand & Gravel Co., and George F. Pettinos, Inc., Philadelphia, Penn.
Mr. and Mrs. John F. Putnam, National Silica Co., Oregon, Ill.
Mr. and Mrs. Henry Roeser, Jr., New Jersey Silica Sand Co., and National Pulverizing Co., Millville, N. J.
Frank T. Rogers, The National Silica Co., Oregon, Ill.
Mr. and Mrs. Charles G. Runkle, Ayers Mineral Co., Zanesville, Ohio
Mr. and Mrs. E. C. Sawyer, Ayers Mineral Co., Zanesville, Ohio
Mr. and Mrs. A. B. Schlesinger, New Jersey Pulverizing Co., New York, N. Y.
Mr. and Mrs. Junius M. Strouss, Deckers Creek Sand Co., Morgantown, W. Va.
Mr. and Mrs. Arnold H. Tanzer, New Jersey Pulverizing Co., New York, N. Y.
Mr. and Mrs. George A. Thornton, Ottawa Silica Co., Ottawa, Ill.
Mr. and Mrs. Henry C. Thornton, Ottawa Silica Co., Ottawa, Ill.
Stanton Walker, National Industrial Sand Association, Washington, D. C.
Mr. and Mrs. A. Warsaw, Wedron Silica Co., Chicago, Ill.
Mr. and Mrs. C. R. Wolf, National Pulverizing Co. and New Jersey Silica Sand Co., Millville, N. J.
Mr. and Mrs. W. H. Woodward, Ottawa Silica Co., Ottawa, Ill.
Mr. and Mrs. Marcus S. Wright, Jr., South River Sand Co., Old Bridge, N. J.

Guests

Mr. and Mrs. Thomas Austern, Washington, D. C.
Wm. M. Avery, PIT AND QUARRY, Chicago, Ill.
Wm. W. Collins, Jr., Pittsburgh, Penn.
Clayton Devine, Silica Sand Traffic Ass'n. of Ill., Chicago, Ill.
T. F. Hatch, Industrial Hygiene Foundation of America, Inc., Pittsburgh, Penn.
Bror Nordberg, ROCK PRODUCTS, Chicago, Ill.
A. M. Ribe, Hardy Sand Co., Birmingham, Ala.
Mr. and Mrs. T. C. Waters, Counsel, Baltimore, Md.

Symposium on Mineral Aggregates

AMERICAN SOCIETY FOR TESTING MATERIALS, Philadelphia, Penn., announces its "Symposium on Mineral Aggregates," including 15 extensive papers, which were presented at the 1948 A.S.T.M. Annual Meeting in Detroit, Mich., and are grouped into six general categories including: distribution, processing and sampling; tests and mineralogical characteristics; aggregates for portland cement concrete; aggregates for bituminous construction; aggregates for miscellaneous use; and needed research. The symposium was sponsored by Committee C-9 on Concrete and Concrete Aggregates and Committee D-4 on Road and Paving Materials, with the following committee in charge: K. B. Woods, Purdue University, chairman; B. A. Anderton, Allied Chemical and Dye Corp.; E. W. Bauman, National Slag Assn.; R. F. Blanks, U. S. Bureau of Reclamation; Shreve Clark, Virginia Department of Highways; R. W. Crum, National Research Council; A. T. Goldbeck, National Crushed Stone Association; Fred Hubbard, The Standard Slag Co.; D. E. Parsons, National Bureau of Standards; and Stanton Walker, National Sand and Gravel Association.

Forty Years of Research

(Continued from page 138)

performance which is required of concrete. It is urgently to be hoped that this situation will be improved.

More than any other group, the manufacturers of portland cement are sincerely concerned with attaining the ultimate possible perfection of concrete. They welcome the intense interest and the close, continual cooperation of all users in advancing toward that end. They recognize the great contributions toward the science, technology and engineering of concrete which have been made by the U. S. Bureau of Standards, the U. S. Bureau of Reclamation, the U. S. Corps of Engineers, the Public Roads Administration, the various state highway departments, public utilities organizations, municipal engineering laboratories, universities, technical schools and others too numerous to mention. The manufacturers of portland cement will worry most if and when such widespread interest ever shows signs of declining.

Meanwhile let it be kept in mind that portland cement is a truly fine chemical, produced on an immense scale, by mill procedures of the most intricate and exacting character and that the men who operate the mills are the ones best qualified to work out and control the manufacturing methods employed. Give these mill men tests and specifications which are direct, technically sound, and related in immediate, demonstrable manner to the ultimate performance required and they will meet them. The cement industry's record of the past proves this claim.

With full recognition of the complexity and importance of the problems which are to be solved, the portland cement industry and the Portland Cement Association look forward to the continued collaboration with cement users which has been so fruitful in the past forty years.

Safety

(Continued from page 137)

ment Co., Cleveland, Ohio; Gen. H. A. Reninger, Lehigh Portland Cement Co., Allentown, Penn.; Walter J. Scahill, Missouri Portland Cement Co., St. Louis, Mo.; W. E. Wing, Marblehead Lime Co., Chicago, Ill.

FORREST T. MOYER, Chief, Accident Analysis Division, U. S. Bureau of Mines, Washington, D. C., discussed the topic "Do We Learn to Operate Safely from the Experiences of Others?", stressing the importance of training the new and inexperienced worker. He presented statistics on injuries at quarries and non-metallic mines in the United States during the past 10 years, and said that the greater percentage of injuries occurred to inexperienced employes, especially men under 20 years of age. For the most part these accidents were falls from the quarry face, falls from elevations such as scaffolds, strains caused by lifting heavy objects improperly, dropping objects, and accidents incurred in the use of track-mounted haulage equipment.

JOHN W. MATHER, Industrial Relations Manager, Lone Star Cement Corp., New York, N. Y., gave an inspiring talk on "Management Sanctions the Safety Program — But How?", outlining responsibilities of the safety engineer in particular. He gave two specific rules for management: (1) to develop "human" sense or the ability to get along with people, and (2) to remember that employes are important people too. The safety engineer should present himself at the induction of a new worker, show him what is being done by the company, show him what he is to do, and explain safety policies. Cooperation between management and workers, praise for work well done, and a real interest on the part of the management are of utmost importance.

"Job Placement and Training" was covered by Joseph Tiffin, Director, Education & Applied Psychology, Purdue University, Lafayette, Ind. By using a simple adaptability test, management can locate those employes who will most likely succeed in a particular job. Several examples of tests already conducted and the results obtained were shown on slides. Mr. Tiffin particularly emphasized the relation of vision to good work and reduction of accidents, showing slides of visual tests conducted and results in relation to safety. General discussion preceded adjournment.

Quarry Safety Awards

ROCK HILL trap rock quarry of the General Crushed Stone Co., at Quakertown, Penn., had the best safety record of all quarries enrolled in the 1947 National Crushed Stone Association Safety Competition, according to Bureau of Mines. This quarry won the bronze plaque provided by the Explosives Engineer magazine for the outstanding achievement of a period of operation of 93,869 man-hours without any disabling injuries through 1947. The Rock Hill quarry has received Certificates of Honorable Mention for injury-free records in 5 other of the past 22 years of competition.

Winchester and Auburn quarries of the General Crushed Stone Co. ranked second and third in the competition, respectively and together with the Rock Hill quarry, operated a total of 244,905 man-hours without any disabling injuries. On the whole, the over-all injury experience at the 50 crushed stone operations in the 1947 Competition was not favorable. The injury-severity rate of 8.902 days lost per 1000 man-hours of work was the highest of any of the annual competitions since their start in 1926.

Manufacturers' News

Pacific Wire Works Co., Seattle, Wash., has opened offices in Portland, Oregon, in Suite 847 of the Pittock Block, according to an announcement by Karl H. Kaye, president. Fred C. Ehlen is local manager.

Chase Bag Co., Chicago, Ill., announces that J. P. Widlar, Kansas City branch representative for the past two years, has been appointed manager of the Denver, Colo., sales office. He replaces R. G. Bullock, new sales manager of the Milwaukee branch.

Caterpillar Tractor Co., Peoria, Ill., has appointed William Kusz as supervisor of industrial advertising. He was formerly special representative and succeeds K. M. Emery, who has been promoted to supervisor of cooperative dealer advertising. Mr. Kusz has been associated with the heavy machinery business since 1940. Other appointments are E. C. Chapman as supervisor of industrial motion pictures; L. L. Morgan as supervisor of agricultural advertising; Fred V. Jacobs as supervisor of engine advertising; and Robert Culshaw as supervisor of picture procurement.

William Kusz

Joy Mfg. Co., Pittsburgh, Penn., has announced the appointment of George W. Bergman as district sales manager at Knoxville, Tenn. He was formerly assistant manager of this territory.

B. F. Goodrich Co., Akron, Ohio, has appointed R. G. Jeter, attorney, as general counsel, with offices at the main plant in Akron, according to an announcement by John Collyer, president of the company.

Link-Belt Co., Chicago, Ill., announces that Ralph M. Hoffman, president of Link-Belt Co., Pacific Division, San Francisco, Calif., has been elected a vice-president of the parent company. He will continue as president of the Pacific Division.

Hewitt-Robins, Inc., Buffalo, N. Y., has appointed Franklin L. Klocke as factory representative for the Hewitt Rubber Division in North Carolina and Virginia and the Hewitt Restfoam Division in the Southeast.

Signode Steel Strapping Co., Chicago, Ill., announces the appointment of A. J. Link as Chicago district sales manager, directing sales in Minnesota and Wisconsin as well as Chicago. He was formerly sales representative in Indianapolis. M. C. Carlson, assistant sales manager and formerly Chicago district sales manager, will control field sales organization entirely.

St. Regis Paper Co., New York, N. Y., has appointed Fred C. Goodwill as resident manager of the Kalamazoo

mill, according to Roy K. Ferguson, president. John H. Heuer will succeed Mr. Goodwill as technical director of the Central Laboratory at Deferiet, N. Y., and Peter J. Massey, formerly resident of the Kalamazoo mill, has been appointed chairman of the New Products Development Committee, with headquarters in New York City.

National Carbide Corp., New York, N. Y., has announced the appointment of George R. Milne as operating manager, with headquarters at the Louisville plant, and the promotion of Russell T. Lund to assistant operating manager, with headquarters, for the present, at the Ivanhoe, Va., plant.

Link-Belt Speeder Corp., Chicago, Ill., has announced the appointment of Robert B. Barnes as sales manager, succeeding Hayes Parsons, who has retired because of ill health. Mr. Barnes was formerly assistant sales manager and previously was district representative in the southeastern territory. He will make his headquarters at the general office and manufacturing plant, Cedar Rapids, Iowa. Mr. Barnes has had a wide experience in the application of power shovels, draglines and cranes in the construction industry and is well known to the entire field.

Robert B. Barnes

Dumpcrete Division of Maxon Construction Co., Inc., Dayton, Ohio, has received the blue ribbon award from the Direct Mail Advertising Association, Philadelphia, Penn., for the best direct mail advertising campaign for 1948 among construction equipment manufacturers.

Twin Disc Clutch Co., Racine, Wis., announces that John H. Batten, executive vice-president and a member of the board, has been elected president of the company to succeed P. H. Batten, who will continue as chairman of the board of directors.

American Brake Shoe Co., New York, N. Y., has appointed Gordon A. Weller as assistant manager of replacement sales, and Frank A. Colosimo as chief service engineer of the Brakeblock Division, with headquarters in Detroit, Mich.

Mack Trucks, Inc., New York, N. Y., has promoted T. J. Zeller to factory manager of the Allentown, Penn., plant, succeeding C. J. Moran, who has been transferred to the western sales headquarters in Los Angeles, where he will assume direction of the plant. A. C. Schliewen succeeds Mr. Zeller as manager of the Plainfield, N. J., plant, where he has been chief inspector for the past three years.

Gar Wood Industries, Inc., Wayne, Mich., announces the resignation of W. H. Hammond as vice-president of sales. After a short vacation Mr.

Hammond will assume a distributorship for the company's products. E. B. Hill, general sales manager, will handle overall sales and distribution. R. D. Hiller, Jr., has been promoted to South Central regional manager with headquarters at Tulsa, Okla., covering the States of Nebraska, Kansas, Missouri, Oklahoma, Arkansas, most of Texas, Louisiana, Mississippi, and parts of Tennessee, Kentucky and Illinois. W. A. Williams has been appointed to succeed Mr. Hiller as district manager in the Southwest.

A. B. Farquhar Co., York, Penn., has announced the appointment of A. H. Dill as Western district manager. He will serve as direct factory representative covering sales and service of all equipment in the far Western states and part of Canada, with headquarters in Menlo Park, Calif. Mr. Dill has been assistant sales manager of the Iron Age Farm Equipment Division for the past four years, mostly in the West. He was formerly associated with Kraft Foods and Republic Aviation.

A. H. Dill

New Holland Machine Co., New Holland, Penn., announces that George C. Delp, president of the company, has been elected a vice-president of The Sperry Corp., of which New Holland is a subsidiary.

Colorado Fuel & Iron Corp., Wickwire Spencer Steel Division, New York, N. Y., has available for public showing a four color sound film entitled "Indian Paint," which runs for 35 min., and portrays the making of steel from ore to finished product—wire rope. Arrangements for showing the film may be made to the company at Palmer, Mass.

Clark Equipment Co., Battle Creek, Mich., has been awarded a citation by the American Legion for giving "exceptional service in the employment of veterans, both physically able and disabled or handicapped." All four plants of the company are covered by the award.

The Euclid Road Machinery Co., Cleveland, Ohio, has promoted V. L. Snow to assistant sales manager, with R. M. Brown succeeding him as manager of sales development. E. F. Armington is director of sales and W. W. Paape is sales manager.

Davey Compressor Co., Kent, Ohio, has appointed the H. B. Fuller Equipment Co., Cleveland, Ohio, as representatives in northern Ohio, and M. C. Burt Equipment Co., Rockford, Ill., as dealers in Illinois.

New York Belting & Packing Co., Passaic, N. J., has appointed F. A. Maskell as sales representative to cover the States of Colorado, Utah, Arizona and New Mexico, with headquarters in Salt Lake City, Utah.

A.I.M.E. Conference

(Continued from page 141)

tively go down from 10-mesh as far as 48- or 60-mesh.

Oklahoma Non-Metallics

W. E. Ham, Oklahoma Geological Survey, in his discussion of recent developments in non-metallics in Oklahoma, commented on high purity industrial sands, coking coals and high grade limestone and dolomite products. Silica sand production started in the Arbuckle mountains in the south central part of the State in 1913 and has grown with development of a glass manufacturing industry. Shipments now average 275 cars a month from three plants. The deposits are covered with from 2 to 20 ft. of overburden, range from 150 to 350 ft. in depth and contain sand of finer than ordinary grains for glass manufacture. The first plant to grind silica flour is being erected. A 1400 acre deposit of high purity dolomite, 44 percent $MgCO_3$, is being exploited and 500 tons per day of a 1- to 6-in. product are being shipped to the blast furnaces at Daingerfield, Texas. Thus far there is only one lime plant, St. Clair Lime Co's., burning high calcium lime. That company has expanded its operations during the past two years. Recently vermiculite has been discovered in the Wichita mountains in southwestern Oklahoma, but prospecting has not yet been started.

Lime

William J. Kuntz, Lime and Hydrate Plants Co., in two papers, "The Manufacture of Lime" and "The Manufacture of Lime Hydrate," described in general terms the York Kuntz automatic lime kiln and the Kuntz system for the hydration of lime. He claimed that lime made by any other process was too costly and particularly so in the case of rotary kilns, while claiming average fuel efficiencies as high as 5½ to 6:1 for his system when coke is used for fuel. Two of the features emphasized were a charging apparatus for providing even distribution of the stone charge into the kiln and continuous drawoff. The kiln is shaft-type, ranging from 11 to 16 ft. in diameter and from 60 to 90 ft. in height. In the hydrator, water is fed into the dust control stack, not into the hydrator directly, through a series of sprays which cover the cross-sectional area of the stack.

Other papers of interest to some of our readers were one presenting statistics of production of the fluorspar industry by W. H. Voskuil and N. T. Hamrick, Illinois Geological Survey; "Structures Due to Volume Shrinkage in the Bedded Fluorspar Deposits of Southern Illinois" by Robert M. Grogan, Illinois Geological Survey; and two on the subject of rutile.

INDUSTRY NEWS

Construct Plant for Glazed Cinder Block

GENERAL SHALE PRODUCTS CORP. has announced plans to manufacture a new glazed cinder block at Kingsport, Tenn., plant. A factory for continuous processing of block, first of its kind in the world, already is under construction. The new block, known as Spectra-Glaze, was developed by the Burns and Russell Co. of Baltimore, Md., and is a regular cinder block, transformed through a patented low-temperature glazing process into colorful interior wall surface having a hard, durable finish. The block will enable the builder to erect a masonry wall and decorate the interior wall in a single operation and provide a maintenance-free, sanitary finish at the same time.

The new factory, measuring 103- x 150-ft., will house machinery which will automatically glaze cinder block and deliver them individually wrapped and ready for use. A wide choice of colors is available, including pastel shades.

Prestressed Concrete Airport Runway

USE of prestressed concrete for airport runways or high-capacity highway slabs should prevent damage by cracking, as reported in *Engineering News-Record.* Introduction of heavier planes has been presenting new problems in airport runway design, with the result that many runways have been using a thicker slab of concrete, as much as 21-in. thick in several cases.

According to Freyssinet, French pioneer in prestressed concrete, this not only is a waste of material, but an ineffective design that will crack and deteriorate. He has placed a prestressed slab, 6-in. thick, at Orly Field, France, which is claimed to be undamaged by cracks, since the prestressing converts the concrete into an elastic material. Cracks are impossible until the prestress is overcome and then, if they do occur, they will close when the load is removed.

N.C.M.A. Regional Meeting

REGIONAL Meeting of the Southeastern Region, National Concrete Masonry Association, was held November 8-10 at the Hotel Robert Richter, Miami Beach, Fla. A report of the meeting will be published in the January, 1949, issue of ROCK PRODUCTS.

Opens Perlite Deposit

NATIONAL PERLITE CO., Campbell, Calif., has completed necessary road construction to perlite deposits near Rutherford, Calif., and has established a quarry from which perlite is being mined and shipped.

Perlite is being expanded on a commercial scale in the State, with prices, when expanded, ranging from 18½c to 33⅓c per cu. ft. in bags. A variety of sizes are available.

Concrete Plant at Air Field

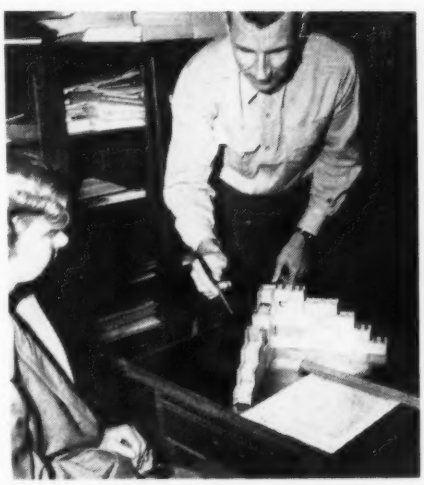
IDAHO CONCRETE PIPE CO., Caldwell, Ida., is one of the many industries in operation at Gowen Air Field. Said to be most unique of industries at the field, the company has leased three corrugated metal buildings once used by the Air Corps ordnance department and the ordnance "butts" where airplane weapons were sighted-in.

The company has constructed an overhead crane system at one end of a building over two machines for the manufacture of "centrifugally" spun concrete pipe. At present Idaho Concrete Pipe Co. is furnishing pipe to be used as main interceptor lines for the new Boise sewage disposal system.

Miniature Building Blocks

MINIATURE building blocks for demonstration purposes, an idea which started as the hobby of an aluminum foundryman, are gaining popularity in the concrete products industry. Frantz Pattern & Foundry Co., Long Beach, Calif., is shipping thousands of the tiny blocks to plant operators and block machinery manufacturers who use them to show prospective block purchasers just how the units are formed into walls, corners and partitions of a building.

The units are cast of aluminum to exact scale, about ⅛ the size of a regular block, and are available in replica for any standard or patented block design on the market. I. O. Frantz is head of the concern.



Concrete masonry construction is demonstrated with miniature blocks

BLIFFERT CONCRETE CO., Milwaukee, Wis., has purchased for $51,000 a crushed limestone and ready mixed concrete plant in that city from G. D. Francey Coal, Stone & Supply Co. Wesley P. Bliffert, president, said that Bliffert Concrete would produce ready mixed concrete, while limestone would be produced by the Fuller Co., of which he is manager. The Fuller Co. previously leased the plant from Francey. Mr. Bliffert formerly was head of the ready mixed concrete division of the Tews Lime & Cement Co.

TIME BRICKCRETE AND BUILDING SUPPLY CO., West Haven, Mass., has been incorporated with $4500 by Frank B. McDermott, president; Anna L. Sobask, vice-president; and Charles Sobask, treasurer and secretary.

MACK'S BLOCK COMPANY has filed articles of incorporation at Dover, Del., showing a capital of 20,000 shares, no par value.

UNIVERSAL CONCRETE PIPE CO. recently presented lapel service pins to 21 employes from the company's 15 plants who have worked there for over 15 years.

BELL CONCRETE BRICK & TILE CO., El Monte, Calif., is currently repairing and replacing machinery, buildings, and offices.

HEISER-ZUNKER READYMIX CO., Wausau, Wis., has been incorporated with 250 shares, $100 each, and a minimum capital of $5000, to manufacture ready mixed concrete, mortar, reinforcing steel, etc. Harold W. and Martha Heiser and Herm F. Zunker are the principals.

ADVANCE CAST STONE CO., Milwaukee, Wis., has been organized with 500 shares, no par value, and a minimum capital of $500, to deal in concrete, building supplies, appliances and equipment. Bruce and Theresia Garni and William J. Zinn are the incorporators.

DELMER WEHMEYER AND HOWARD STEFFEN are producing concrete block at Chamois, Mo., at the rate of 400 units per day. Sand is delivered from the Jefferson City Sand Co., and shipments of No. 8 torpedo gravel come from the Missouri-Illinios Material Co. of Pacific, Mo.

T. T. WILSON READY-MIXED CONCRETE CO., Chattanooga, Tenn., has started construction of a concrete batching plant which is said to be one of the largest and most modern in the entire South. Capacity will be 180 cu. yd. of concrete per hour. Overhead bins will have a capacity for 800 bbl. of cement and 500 tons of sand and gravel.

COLDEN CONCRETE PRODUCTS CO., West Falls, N. Y., is the business name filed by Leonard T. Kubicki, Daniel J. Gawron and Richard N. Gawron.

READYMIX CONCRETE CO., Danville, Ky., has been granted a charter with capital stock of $60,000. J. D. Turner, Jr., W. Walter Thorp and William B. Gess are the principals.

Expanded slag storage yard with reclaiming scraper conveyor extending right from bottom of overhead bin, left. Background is building housing production lines and steam curing tunnels

Straight-line production system makes lightweight block formed from two 3-in. slabs tied together by steel bars to form a continuous type cavity wall for housing project at Clydebank, Scotland

SCOTCH BLOCK PLANT

By HENRY E. DE WEERDT*

IN THE BURGH OF CLYDEBANK, an important shipbuilding center on the west coast of Scotland that was extensively damaged by air raids during the war, a large scale housing project is being erected with lightweight block produced in the plant of Henry E. De Weerdt. These block, measuring 8- x 8- x 32-in., are so constructed that when laid up, they form a continuous cavity wall. Aggregate for these block is expanded blast-furnace slag. The block plant is located approximately in the center of a site where 106 three and four apartment buildings containing a total of 504 units are to be constructed.

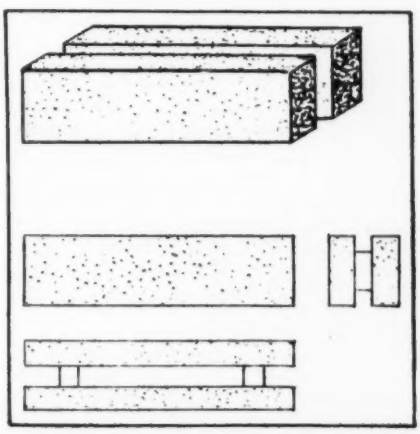
Block manufactured at this plant differ from the conventional block produced in the United States in that they have no web, but in reality are two concrete slabs with a 2-in. air space between. Two 3-in. thick 8- x 32-in. slabs are tied together by two galvanized steel rods at each end to produce one block with a 2-in. dead air space in the center. Compressive strength of these block exceed 900 p.s.i. at the end of 28 days.

The plant has been erected at the housing site for the duration of the contract, and therefore is semi-portable. A steel overhead aggregate bin is charged by a bucket elevator that is fed in turn by a horizontal scraper conveyor on 50-ft. centers. The scraper conveyor is mounted on a steel framework much as a belt conveyor and can be swung through an arc of 100 degrees in the aggregate stockpile yard so as to reclaim from aggregate piles dumped by trucks. The conveyor arm can also be raised or lowered. A weighbatcher is mounted under the bin and serves a concrete mixer. The plant is provided with two batteries of three steam tunnels each for block curing. At the discharge end of the tunnels is located a pneumatic system for removing sand from the forms that has been used to keep them separated during curing. The plant also maintains its own testing laboratory.

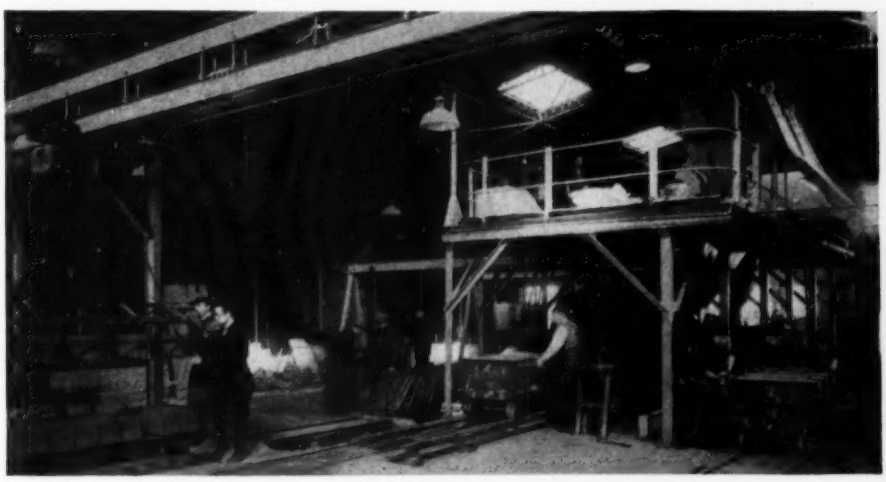
Molds, each forming two slabs or one complete block, are mounted five to a car on a track system that carries them through the moulding machine where concrete is placed, the vibrating station, the grouting and tie insertion stations. A car of five molds is removed from the curing tunnels every 75 sec. This yields a block production of 240 per hr. per machine. After the blocks are formed, the car moves to the steam curing tunnels, and following two hours curing time, the cars emerge at the opposite end where pallets are removed and block transported to the storage yard after passing the pneumatic de-sanding station.

Block types for this project have been held to a minimum, and consist of the regular block; corner, window, door and closed-end blocks. Single 3-in. thick slabs are also used.

Blast-furnace slag is expanded at a plant about 10-miles from the construction site and hauled in by truck for a daily total of 40- to 50-tons. Aggregate used for these block weighs 30 lbs. per cu. ft. when in the usual grading of ⅛- to ½-in.



Details of two-slab block that forms continuous cavity wall when laid up



Production line at first station where molds are filled with lightweight concrete. At left is electric hoist removing slabs from car after two hours in steam tunnels

*Block plant owner, engineer; former resident of Scotland, now in Canada.

CONCRETE

Central-Mix, Ready-Mix, Block

Dual batching plant of Louisville Crushed Stone Co., Louisville, Ky., proportions concrete materials automatically to concrete products plant or to central mixer charging ready mix trucks

AN OUTSTANDING new plant to manufacture concrete products and to batch ready-mixed concrete has just been completed by Louisville Crushed Stone Co., Louisville, Ky., a subsidiary of Ralph Rogers Co., Bloomington, Ind.

Aggregates for the plant are shipped by rail from a near-by company quarry. Materials, recovered from a rail hopper by a 30-in. belt, may be conveyed directly to overhead bins above the plant or may be stockpiled radially by a mid-section of the same belt conveyor system (see illustration to right, below). First section of this conveyor system, that can be seen emerging from tunnel under tracks, is a 30-in. belt on 132.5 ft. centers, rated at 200 f.p.m. and powered by a 15 hp. motor. The second section, pivoted at the transfer point from section one, is a 24-in. belt on 78.5 ft. centers rated at 300 f.p.m. and powered by a 15 hp. motor. This section may be swung in an arc of 270 degrees or may be left in line to discharge to the third section of the belt system. Materials are recovered from stockpiles by a bucket loader, dump-truck combination. The truck dumps to the track hopper.

Third section of the belt system delivers aggregates to the eight compartment overhead bin of 400-cu. yd. total capacity at a point 170-ft. above grade. This section is a 24-in. belt on 221 ft. centers, powered by a 25 hp. motor. Rated capacity of this system is 300 t.p.h., with belting on the three sections as follows: 5 ply, 28 oz.; 4 ply, 28 oz.; 4 ply, 32 oz., respectively.

Cement is delivered in covered hopper railroad cars and transferred to the bucket elevator from a track hopper by a 10-in. screw. A swing spout at the top of the cement bucket elevator directs the flow to either of two overhead bins for the dual weighbatchers or to a two compartment ground storage bin of 1000 bbl. capacity. This system handles 300 bbl. per hr. All cement bins are fitted with indicators and alarms that automatically signal high or low cement levels.

Concentric Weighbatchers

Two 2-cu. yd. concentric weighbatchers are located under the aggregate bins. These weighbatchers are fully automatic and of the accumulative type. The cement batcher is hung on a separate scale within a compartment of the aggregate batcher. Water for the ready-mixed concrete central mixer, a non-tilting type of 2-cu. yd. capacity, is weighed while water for the 50-cu. ft. block machine mixer is metered. Fill and discharge of these weighbatchers is controlled electrically through air-ram gates. All controls for the weighbatchers are located at a point between the two batchers and on the mixer floor level.

Equipment Suppliers

The conveyor system was designed and furnished by Barber-Greene Co. and the overhead bins and weighbatchers were manufactured by the C. S. Johnson Co. The pre-mixer is a Koehring 56-S and the block machine mixer is of Stearns manufacture, as is the block machine. Provision has been made under the block batcher through a pants-leg chute for future installation of a second block machine. At the present time the company maintains a fleet of eight Jaeger truck mixers.

Upper right: Plant, background, that houses dual weigh batch equipment for concrete block mixer and central mixer for ready-mix concrete delivery trucks. Extreme left may be seen discharge end of stacker belt to aggregate pile. Immediately to right of aggregates is bucket loader that is used to reclaim aggregates for delivery to receiving hopper

Lower right: Detail of three sections of rail hopper feeding plant belt conveyor. Mid-section can connect to third section for material elevation to overhead bin or can be manually swung in 270 degree arc as stacker belt for aggregate storage. Belt, foreground, emerges from track hopper, which also receives stockpiled aggregates from trucks

Below: Back of plant, showing covered block storage area and part of eight unit fleet of agitator trucks. Turn head above aggregate storage bin can be seen behind block storage area

Left to right: Thurmond Bogue, superintendent; P. F. Quinn, master mechanic; Miss Martha Hornsby, office secretary; and Lloyd M. Parker, president

Process perfected in Sweden enables American producer to manufacture remarkably high strength concrete gratings, using a harsh mix and water-cement ratio of 0.4

By M. W. LOVING*

Concrete Placed By Precision Vibration

A CONTRACT was awarded the Mid-South Concrete Pipe Co., Memphis, Tenn., of which Lloyd M. Parker is president, to manufacture 1400 reinforced concrete gratings to be used for surface drain covers at the U. S. Naval Air Station near Memphis. Designed by Commander E. B. Hickey, CEC, USNR, and Mr. T. H. Jackson, Civil Engineer, the gratings are 6-ft. long, 22-in. wide and 7.5 in. in thickness. With 15 openings and the complicated steel reinforcement assembly, there was not much room left in the steel moulds for the concrete which, under the specifications, was required to develop a compressive strength of 4000 p.s.i. at 28 days. Moreover, Mr. Parker had promised the Consolidated Contractors of Memphis, who held the contract for the installation of the gratings, delivery of 15 units per day and he expected to have to buy or make 15 of these expensive steel moulds in order to meet his schedule.

Instead, only two master moulds were required to make 30 gratings each day in 8 hr. and the compressive strength of the concrete, as determined with cylinders made with the concrete and cured with the gratings, averaged about 4000 p.s.i. at 3 days and 6000 p.s.i. at 7 days. Because the cylinders were not subjected to the precision vibration as effectively as the concrete in the gratings it is safe to say that the concrete in the gratings will exceed 10,000 p.s.i. in compressive strength, when they are placed in service. The concrete mixture used had a water-cement ratio of about 0.4, because only 2.2 gallons of water per sack of cement was used to make the dry, harsh concrete mixture.

*Consulting Engineer.

Fig. 1: A paddle type concrete mixer was required to mix the dry, harsh concrete for 5 minutes

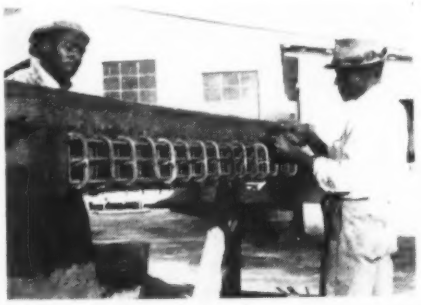


Fig. 2: Workmen fabricating the reinforcement assembly at a natural level; this is efficient planning

Each of the two master moulds were fitted with two Topdog, Swedish vibrators and it required from 5 to 7 minutes to make this concrete semi-fluid and consolidate it in the moulds, and around the reinforcement. Then the moulds were removed right away.

On October 12, 1948, I flew to Memphis to examine and photograph the several operations of the manufacture, testing, transportation and installation of these reinforced concrete gratings. Through the courtesy of Captain C. O. Taft, USN, Commanding Officer and Commander E. B. Hickey, CEC, USNR, Public Works Officer, U. S. Naval Air Station, Memphis, Tenn., and Rear Admiral R. F. Whitehead, Chief of Naval Air Reserve Training, U. S. Naval Air Station, Glenview, Ill., I was permitted to take action pictures depicting the installation of the gratings. This is of unusual interest to engineers and contractors.

Manufacture of Gratings

Because pictures speak louder than words and are far more convincing, you are shown how everything was done. The harsh, dry concrete had to be mixed for 5 minutes in a paddle mixer, Fig. 1, and the steel reinforcement assembly, made by two workmen at a natural level, can be seen in Fig. 2. The steel mould is being placed over the steel reinforcement assembly in Fig. 3, with a close-up view shown in Fig. 4. You will note that concrete pallets were used and the steel mould was securely bolted to it; the gratings were cast with the top side down, because the design required beveling around the 15 openings. This was at long last accomplished by Mr. Parker, after many headaches and considerable expense, by mouldings in the concrete pallets as can be seen in Fig. 5. Coated with paraffin oil, before the concrete was placed, the top surface of the gratings did not adhere

Fig. 3: This handy rig was used to handle the moulds, concrete and the gratings

Fig. 4: Close-up view of the mould, as it was being adjusted over the steel reinforcement assembly on the concrete pallet

to the pallets at the end of the steam curing period of 12 hours. Steel sheet pallets were first made at considerable expense, but the stampings for the bevel edges was a real problem and, besides, the concrete pallets afforded more effective vibration.

The two Topdog vibrators are provided with steel brackets, to which the vibrators are firmly secured with a locking lever. To each side of the steel mould, a ship channel is welded; to this is welded the steel bracket, furnished with the vibrators. This can be seen in Fig. 6 and also the harsh, dry concrete which has already been deposited on the mould, with a bucket of required capacity conveyed by the same rig, shown in Fig. 3. Just as soon as the vibrators are in operation, the dry, harsh concrete shown in Fig. 6 becomes semifluid and the workmen are shown in Fig. 7, busy with trowels after about one minute of precision vibration. This remarkable operation is explained by the Svenska Cementföreningen (The Swedish Cement Association), Stockholm, Sweden in these words:

"The effect of vibration is to convert the consistency of concrete from harsh to semifluid, while plastic concrete becomes fluid.

"This change in consistency is due to the fact that rapid vibration neutralizes the static friction between the particles of the various materials contained in the concrete, causing the concrete to be spread out by gravity. As soon as the vibration ceases, the particles are again immobilized by friction (see Fig. 8 and the caption). This phenomenon is, to a certain extent, analogus to the fusion of solid substances under the application of heat, in which case the molecules and groups of molecules are released by thermal vibrations or oscillations, as it were, but become linked together again as the substance cools down and re-solidifies.

"Owing to this reduction in internal friction between the particles of concrete brought about by vibration, the mix subsides by gravity with the result that its volume decreases by 10 to 15 percent as compared with the volume it had prior to consolidation by vibration; its density increases to a corresponding degree and excess air is removed."

After I read this to Mr. Parker in Memphis we tried it out, Fig. 8. While the vibrators were in operation, he could stick his finger in the concrete; just as soon as the vibrators were stopped, he could not stick his finger or a steel rod in the concrete.

After 5 to 7 minutes of precision vibration, the moulds are removed as shown in Fig. 9 and the finished grating is shown in Fig. 10; only a little troweling is required and the embedded wire loops are for handling after the concrete hardens. Right away the gratings are covered with wet burlap for preliminary curing. At the end of the day's work the gratings are covered with tarpaulins and steam cured for 12 hours, when they are removed from the concrete pallets and placed on a sand bed. Covered again with burlap, the gratings are cured for 48 hours, by keep-

Fig. 5: One of the concrete pallets, showing the moulding in the concrete to form the beveled edges for the topside of the gratings

Fig. 7: About one minute after the two Topdog vibrators were in action, the concrete melted down like this and more concrete was required to fill the mould

Fig. 9: Removing the mould after 5 to 7 minutes precision vibration, note the excellent appearance of the gratings

Fig. 6: The dry, harsh concrete mixture, which has a water-cement ratio of only .4, is placed on top of the mould

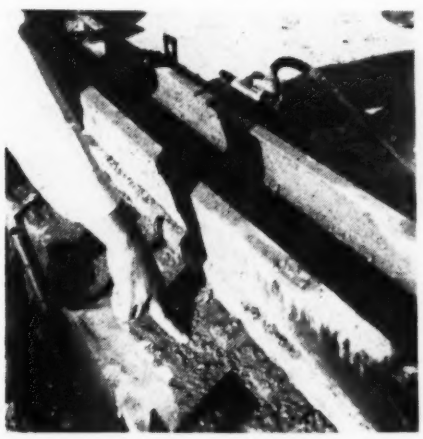


Fig. 8: While the vibrators are in operation you can stick your finger in the concrete; when the vibrators are stopped you can not stick your finger or a steel rod in the concrete

Fig. 10: Very little finishing is required; the wire loops are for handling the grating—after the concrete hardens. All the gratings were cast with the top-side down

Fig. 11: After curing, as described in the text, the gratings are racked up and stored like this

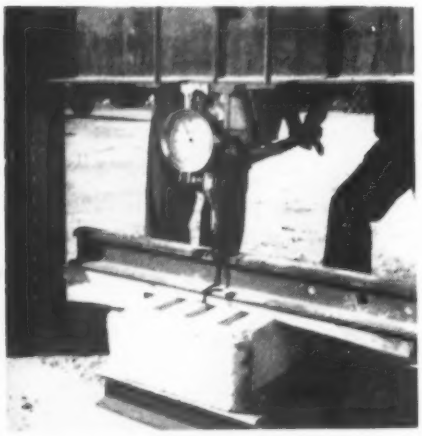


Fig. 12: Tested to 40,000 pounds, the limit of the jack, this cut-section was not damaged

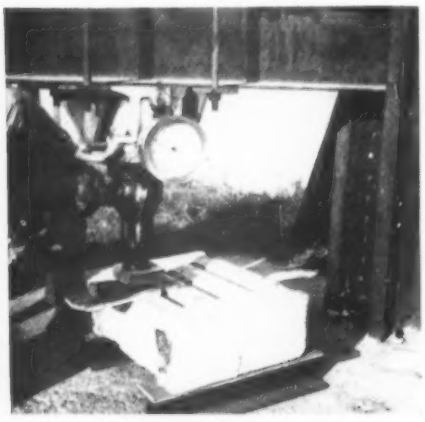


Fig. 13: One louver was subjected to a concentrated load of 34,000 pounds, before the cracks shown developed

Fig. 15: Here is what they are used for—to replace wooden gratings

ing the burlap covers constantly wet with intermittent water spray. Then they are racked-up for storage as shown in Fig. 11 and in this picture you can see some of the gratings on the sand bed, while curing, in the left background.

While this is not a part of the regular testing procedure, we were interested in the structural strength of these gratings. A short section was cut and placed on the testing machine, Fig. 12; supported by two steel rails, the load was applied through a steel rail on top of a piece of hard wood. The 40,000 lb. load, the limit of the hydraulic jack, did not affect this section. Then, a concentrated load was applied to one of the louvers at the end, Fig. 13 and this withstood 34,000 pounds when the two cracks developed, one directly under the jack and on the side shown in the foreground. This indicates a tremendous bond-strength, between the steel and the concrete, because there is not, and can not be, entrained air and free water under the steel reinforcement. This is one of the many advantages of precision vibration of harsh, dry concrete mixtures over conventional vibration of plastic concrete mixtures.

Transportation and Installation

Loaded on company trucks, the gratings are delivered every day, Fig. 14, and in Fig. 15 you can see what they are used for. When these drains were constructed before the war, wooden louvers were installed and were mitered against the side walls which tapered inwards. Thus, about 2-in. of concrete at the top of the walls had to be sheared off, so the new

(Continued on page 203)

Fig. 14: Loaded on a Mid-South Concrete Pipe Company truck, the gratings are transported to the Naval Air Station

Fig. 16: Under-cutting the concrete walls for blasting off the side with Primacord; please read the text

Fig. 17: Laying the Primacord along the wall about 2-in. from the inner surface and weighing it down with steel rail-sections

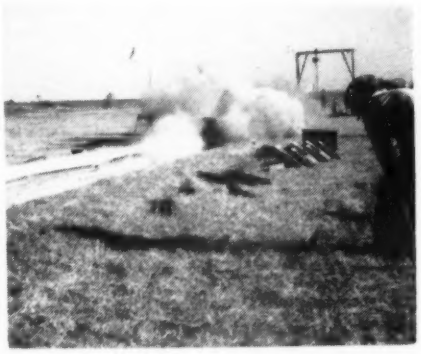


Fig. 18: The explosion, with the battery operator shown in the right foreground

Fig. 19: Installing the precision vibrated concrete gratings

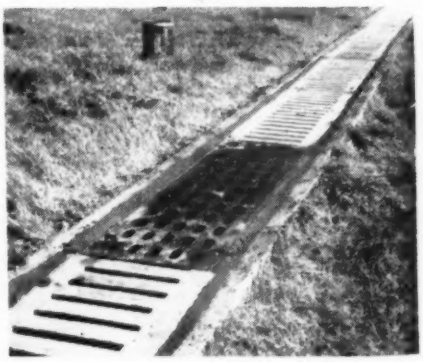


Fig. 20: The finished job, with a cast iron grating which cost three times more, for access to the drains

Handle Ready-Mix and Concrete Materials

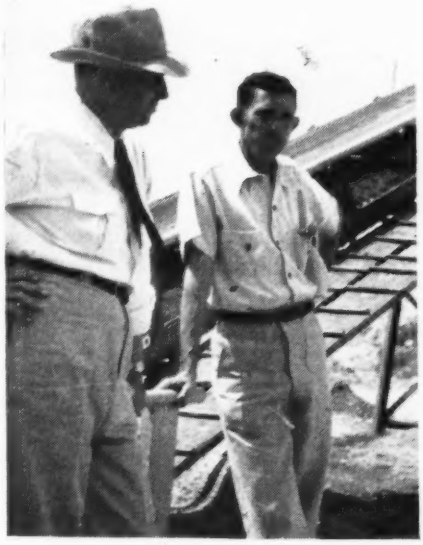
Smooth aggregate handling system featured at Jackson Ready Mixed Concrete Co.

By W. B. LENHART

General view of main plant. All concrete is pre-mixed. Note agitator truck, to the right, taking a load of concrete from mixer hopper

REFLECTING the rapidly developing industry of the South, Jackson, Miss., is one of the fastest growing cities in the state. In the area are two ready mixed concrete operations and the youngest of these is Jackson Ready Mix Concrete which began operations about two years ago. A third company, organized recently under the name of the Woods Building Materials Co., was taken over by the Jackson Ready Mix Concrete, but its plant has not operated and is being kept in stand-by condition by the new owners. However, a brief description of this rather neat plant is included. Jackson Ready Mix Concrete is owned and operated by W. H. Day and H. N. Day. The main plant and company offices are located very close to the industrial section of Jackson. In addition to ready mixed concrete, the company markets sand and gravel but it does not produce material. Masonry sand, mortar mix, bag cement and similar building materials also are sold.

A fleet of 20 mixer trucks is operated, the majority Smith's with a few Rex and Jaeger units. In all there are 32 mobile units, consisting of the above equipment, dump trucks, pickups, trucks, etc. The mixer equipment is mounted on International and Studebaker chassis. Mixer trucks are all painted a bright yellow color, and are kept neat and clean.



W. H. Day, manager, to the left, and G. T. Nichols, plant superintendent

Aggregate Handling System

Aggregates are delivered to the plant in gondola and hopper railroad cars with a short and separate stub track for the bulk cement cars. Cars are spotted at points of unloading by a Link-Belt car puller using a ¾-in. steel cable. Aggregates are unloaded to a track hopper feeding a belt conveyor that inclines up to a shuttle conveyor over the outside aggregate storage piles. There are three bunkers, two for sand and one for gravel. Under this stockpile is a 24-in. reclaiming belt conveyor served by seven gravity-type gates. This reclaiming belt delivers to a long inclined belt that discharges to any one of the four, steel, 75-ton capacity, Butler bins over the batchers. All the conveying equipment was supplied by Continental Gin Co. In addition to the previously mentioned aggregates, ground storage is provided for pea gravel, vermiculite and expanded slags. When these aggregates are being processed through the batchers they are delivered by truck to the belt conveyor system serving the main stockpiles and the shuttle conveyor is moved to the extreme end of its travel where it can unload to a steel hopper that straddles the main inclined conveyor serving the plant. As shown in one of the illustrations, an inclined chute conveys the material to this hopper.

This steel bin along with the "day" bin over the batchers will hold a carload of pea gravel, but the main stockpile holds about 100 carloads of aggregate. It takes about 30 minutes to unload a car of sand or gravel. The belts to the shuttle are 24-in. The gravel in the area is all minus 1-in.

Bulk cement is used but if for any reason it is desired to use bagged cement the sacks are placed on the main inclined belt and delivered to a point well above the batching equipment. Here the bags are removed by hand labor and placed on another inclined chute that delivers them to the batcher floor. At that point they are opened and dumped into another chute to the mixer. Any dry admixtures or high-early-strength cements are likewise delivered to the batcher platform by this novel arrangement. The company is starting experimental work relating to the use of Pozzolith and of Trimix. The Pozzolith is mixed in two mixer tanks and dispensed with Master Builders Co. equipment.

Inclined chute delivers little called for aggregates to the storage bin

Premix Concrete

On the bulk cement side there are three steel silos having a total capacity of 1750 bbl. of cement. A screw conveyor under the track hopper discharges to the boot of a bucket elevator that in turn serves the three silos or the "day" bin in the batching plant by means of a swiveling hopperchute. The Butler batching equipment is a three-beamed unit. Cement is weighed, but water is measured out by volume. All concrete delivered from the plant is pre-mixed. Two 2-cu. yd. Ransome mixers dump to a steel hopper outside the main building. The mixer trucks load from this hopper. A service garage and a room for repairing inner tubes are provided.

Standby Plant

At the stand-by plant formerly operated by Woods Building Materials Co. on Illinois Central trackage, a Blaw Knox plant and batcher is available to produce premixed concrete in a 2-cu. yd. mixer. The Blaw Knox scales have five beams. The plant is a very neat appearing unit of steel and concrete throughout.

Tripper and conveyors at stand-by plant. The end chute is for delivery of aggregate to the final belt serving the plant

Scales, mixer, bin, and cement elevator at the standby plant

Here the aggregates are unloaded to a track hopper that serves a belt conveyor system (all 24-in. belts) comprising three separate units. The final unit is the belt over the stockpile. This belt is unloaded by a Continental Gin Co. tripper, and all the conveyors are of the same make. One novel feature of the arrangement here is that the tripper can side-unload to the two ground storage pockets, or it can dump to the main belt serving the plant. To do this the tripper unloads through an end chute right back onto its own belt and this belt end dumps to the final conveyor belt. The tunnel reclaiming belt under the stockpile delivers to the second belt in the aggregate-unloading belt conveyor system. Bulk cement is delivered to its silo by a bucket elevator.

Official personnel of the company includes: W. H. Day, manager; G. T. Nichols, plant superintendent; W. L. Bonner, ready mix plant superintendent; and L. P. Sweeney in charge of the office.

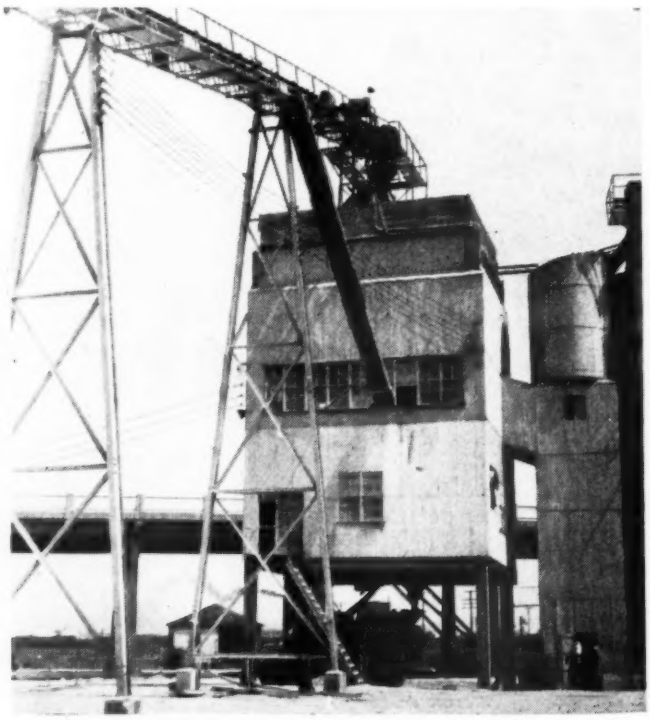
Survey on Concrete Pipe Sewers

American Concrete Pipe Association, Chicago, Ill., announces publication of its 1948 Survey of Concrete Pipe Sewers, a 135-page illustrated book covering concrete pipe sewers classifications in the brochure include sewers 50 years old or more; concrete pipe sewers 50 miles long or more; typical installations; development of Metropolitan Atlanta, Ga.'s sewerage system; an index of concrete pipe sewer survey in the United States, and actual reproductions of individual survey reports. This survey, the first made in this particular manner, may be obtained by members of the industry from headquarters for $1.00, according to Howard F. Peckworth, managing director.

Doubles Production

Economy Fuel & Supply Corp., Buffalo, N. Y., has doubled its capacity for production of lightweight aggregate from slag at the Susquehanna plant of the Nanna Furnace Corp. The expansion program has lifted output to 200,000 cu. yd. per year.

Outside storage bins for various sizes of aggregate. A shuttle conveyor distributes aggregates from inclined conveyor into bins



Main conveyor from aggregate storage to plant bins. Bagged cement is chuted to batcher floor by chute under main conveyor

"and it shall be the duty..."

. . . of the members of the Truck Mixer Manufacturers Bureau, in the interests of our customers, to accurately conform to the standards established by the Bureau guaranteeing the size and capacity of truck mixers.

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To us, it represents an essential protection against the loss of customer good will that might be caused by the confusion of a multiplicity of sizes . . . by constant changes in capacity with resultant early obsolescence of existing machines.

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Truck Mixer Manufacturers Bureau

Affiliated with The National Ready Mixed Concrete Association

BLAW-KNOX DIVISION Pittsburgh, Pa.	CONCRETE TRANSPORT MIXER CO. St. Louis, Mo.	RANSOME MACHINERY COMPANY Dunellen, N. J.
CHAIN BELT COMPANY Milwaukee, Wis.	THE JAEGER MACHINE COMPANY Columbus, Ohio	THE T. L. SMITH COMPANY Milwaukee, Wis.

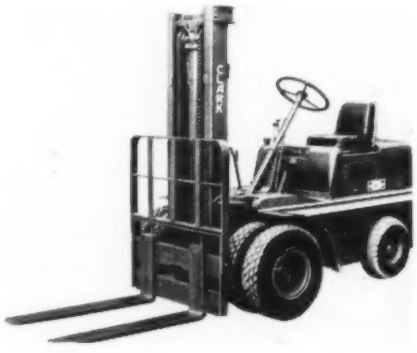
NEW MACHINERY

Charge Indicator

GOULD STORAGE BATTERY CORP., Trenton, N. J., has announced a new charge indicator which gives the momentary charge condition of the battery, thus keeping the operator informed as to its state-of-charge throughout the shift. The dash-board mounted instrument is said to be of lower cost than similar instruments; have the ability to report the state of discharge at any instant rather than conceal vital information until the danger zone is reached; and provide tamperproofness against piece-work operators looking for the last half-hour pay at the expense of the battery.

Wide Drive Axle

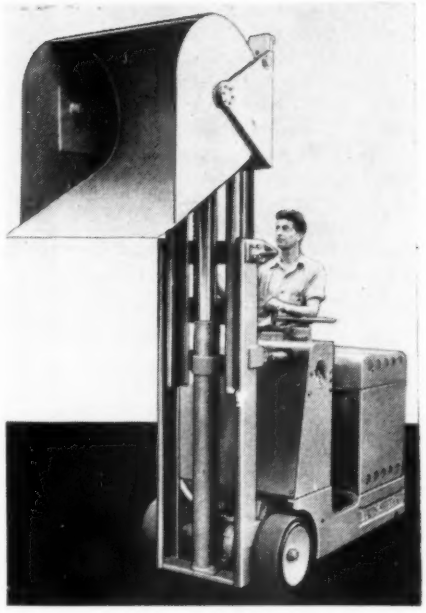
CLARK EQUIPMENT CO., Industrial Truck Division, Buchanan, Mich., has developed a special wide drive axle, mounting dual tires, to provide utmost stability and safety in high-lift operation of pneumatic tired fork trucks. The new wide axle is recommended for all Clark Yardlift "40" models where operations require lifts of more than 144 inches. Tests show that the dual tires provide considerably more traction and greater flotation for smoother, safer operation. The axle is now available for factory or field installation. Special fenders are included.



Wide drive axle mounting dual tires

Dump Buckets for Fork Trucks

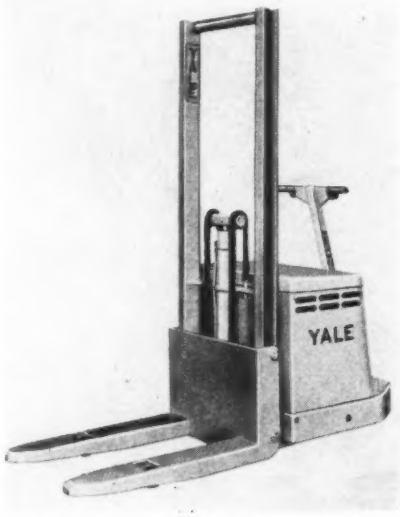
LEWIS-SHEPARD PRODUCTS INC., Watertown, Mass., has announced a dump bucket attachment for L-S "Standrive" Power Fork Trucks which is said to help reduce time and effort in handling many kinds of loose and hard-to-manage materials such as sand and gravel. The attachment is designed for loading and unloading railroad cars and highway trucks, for movement of materials from stockpile to work site; and for filling bins, mixers, grinders, etc. The load is dumped by releasing a latch, and when empty, the bucket returns to a locked upright position upon being lowered. The bucket is of arc-welded heavy-gauge steel plate, with alloy steel leading edge beveled for easy scooping.



Dump bucket attachment for lift truck

Electric Pallet Truck for Confined Areas

YALE & TOWNE MANUFACTURING CO., Philadelphia, Penn., announces a new low-cost, high-lift Worksaver electric pallet truck with 2500-lb. capacity. The truck is battery-operated both for travel and lifting loads, is 39- x 31-in. overall dimensions, not including forks, and lifts pallets 66 in. for overhead tiering. The mast is 83-in. high, permitting the truck to enter low head room spaces, and its small overall dimensions permit use in confined areas such as narrow aisles and crowded production zones. Engineering specifications and operational data may be obtained from the company in Bulletin P-1102.



High-lift electric truck for confined areas

Precision Vibration

(Continued from page 198)

gratings could be installed; this was expensive work as the concrete was of unusual strength. The contractors were fortunate in having an ex-marine veteran as foreman and he knew about and was experienced in the use of Primacord. In Fig. 16 the workman is under-cutting the vertical wall at the base with a pneumatic drill; notice the steel rail-sections laying alongside the wall. After a section about 30-ft. long is so drilled, the Primacord is laid on the walls about 2-in. from the inner surface, Fig. 17, and the steel rail-sections are placed on it as shown. The opposite wall has, in the meantime, been treated the same way for the same distance. Then the rail-sections are weighted down and the ends of the Primacord wired to a battery, to explode it. Being an experienced hunter, I asked the battery operator to stand in front of my camera so I could take the picture shown in Fig. 18. The walls were shattered, as you would expect after that blast, but were sheared off clean and required very little trimming.

The reinforced concrete gratings, made with precision vibrated concrete, are being installed over the surface drains in Fig. 19 and the finished work is depicted in Fig. 20; the cast iron grating, which cost three times more than the reinforced concrete gratings, can be removed for access to the drains as the concrete gratings are sealed to the walls with portland cement mortar.

Concrete Group Adopts Name

MANUFACTURERS of concrete products in north central Ohio have adopted the name "Concrete Manufacturers Association North Central Ohio" for their organization which was founded last year. An official seal and objectives of the Association have been established.

California Block Meeting

CONCRETE MASONRY MANUFACTURERS ASSOCIATION of Southern California recently met in Bakersfield, Calif., with 50 in attendance. V. Rapp, Los Angeles City Building Dept., spoke, and Adrian Wilson, Architect and past president of A.I.A., gave examples of the necessity of good architecture in planning concrete block buildings. Al Ottum, Radiant Sales & Engineering Co., discussed proper installation of radiant heating systems.

•

DAVID CRAWFORD has rented the Coykendall stone quarry near Red Mill, N. Y., with plans to erect a crushing plant on the site. Mr. Crawford also plans to sell ready-mixed and transit-mixed concrete.

Visits Texas in National Tour

GEORGE W. KATTERJOHN, president, National Concrete Masonry Association, recently spent two days in Houston, Texas, as part of his tour of concrete products plants throughout the country. In conferring with a group of Houston members, Mr. Katterjohn said that the Southern Regional Convention of the Concrete Masonry Association probably will be held in Houston next year with about 500 in attendance. The national president also said that the industry is entering the architectural field with production of a Roman slump brick in a variety of colors.

Bibliography on Prestressed Concrete

ENGINEERING SOCIETIES LIBRARY, 29 West 39th Street, New York 18, N. Y., has announced a bibliography on prestressed reinforced concrete, consisting of 190 references to books and articles in publications from all over the world. ESL Bibliography No. 2 supplies annotated references covering all aspects of the subject, including theory, design, construction practice, and applications. The bibliography may be obtained from the Library at a cost of $4.00.

Go with "Gocorp"

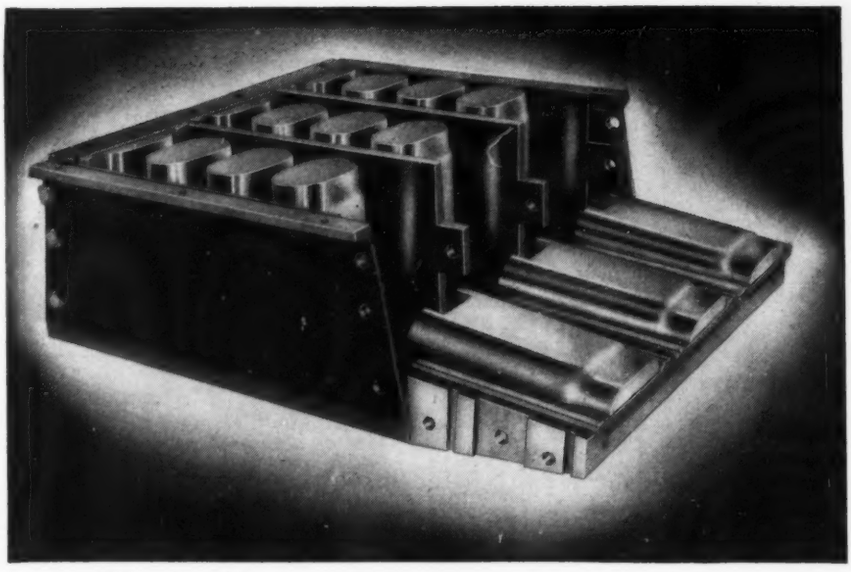
EUGENE F. OLSEN, president, The Gene Olsen Corp., Adrian, Mich., announces that C. S. "DEL" DELAMATER and T. H. "TED" MERRIAM have joined the sales staff of the corporation. Mr. DeLamater recently resigned

C. S. DeLamater

his position as director, vice-president and sales manager of Stearns Manufacturing Co., Inc. He has long been associated with the concrete products machinery industry, first as sales manager for Anchor Machinery Co. and then with the Consolidated Concrete Machinery Co.

Mr. Merriam has resigned his position as manager of the Eastern office of Stearns Manufacturing Co., with which he became associated in 1943 as director of field operations. In 1928, Mr. Merriam joined the staff of the Portland Cement Association, Chicago, Ill., under W. D. M. Allen. Later he transferred to the Michigan office and took an active part in the development of the concrete masonry housing program, especially in conjunction with the Detroit Concrete Products Association.

T. H. Merriam



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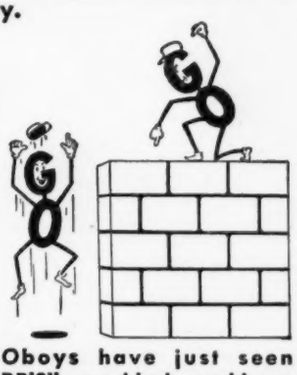

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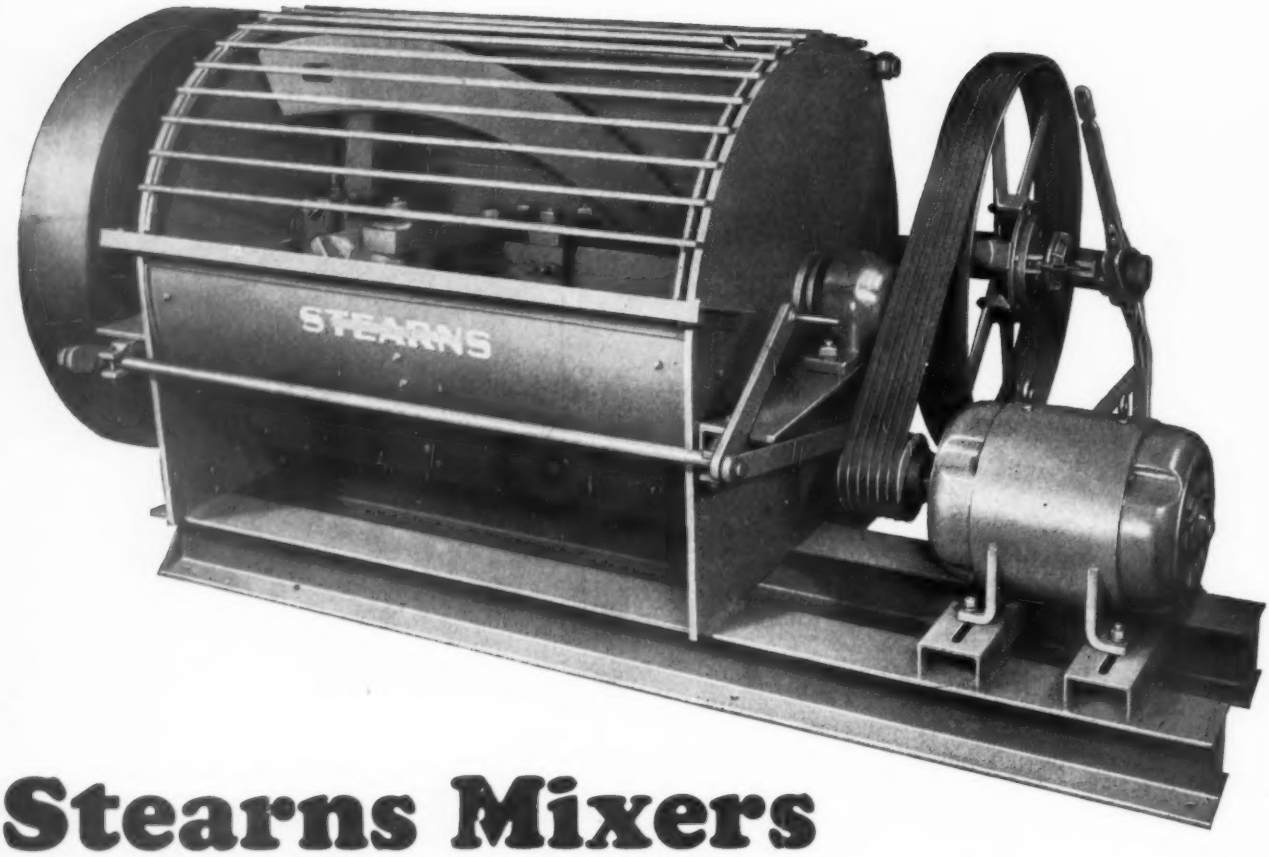

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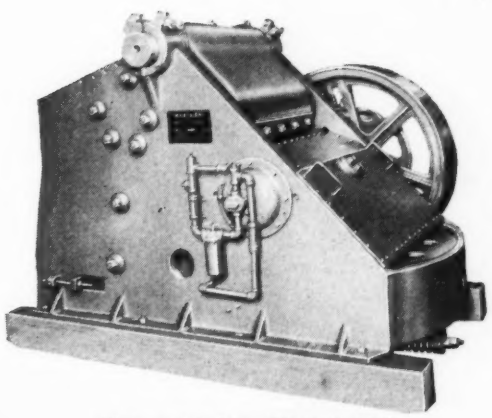

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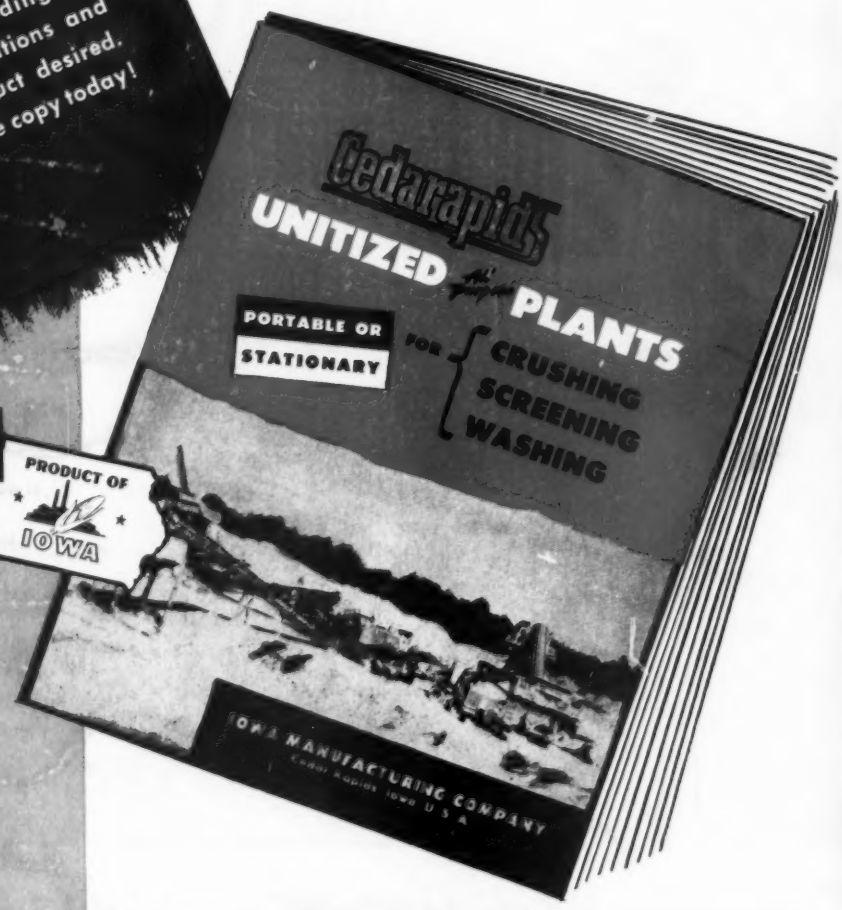

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